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THE DEVELOPMENT OF GERMAN DOCTRINE AND COMMAND AND CONTROL AND ITS APPLICATION TO SUPPORTING ARMS, 1832-1945

by

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THE DEVELOPMENT OF GERMAN DOCTRINE/COMMAND AND CONTROL AND ITS APPLICATION TO SUPPORTING ARMS, 1832-1945

by

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ABSTRACT

This thesis describes how German doctrine and command and control evolved in World War II with respect to supporting arms. Structured knowledge of a subject, based on empirical data and experience, contributes to successful practice and future development. The German experience of the Second World War is used to discern the applicable lessons of command and control for understanding the development of modern warfare as it relates to supporting arms.

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I. INTRODUCTION

A. PURPOSE

Perhaps the most challenging yet overlooked task before any military officer is the need to understand how weapons and their concept of employment have evolved in conjunction with doctrine and command and control. This understanding is necessary for the application of lessons learned to future developments in warfare. The late Soviet Minister of Defense, Marshal A. A. Grechko once noted:

> Many of the tactical methods that proved themselves in the last war retained their significance under present-day conditions.

The Germans and their doctrine and their command and control have had a profound impact on warfare during the last two centuries. Their dynamic thinking in World War II, even with its serious shortcomings, influences military thought today.

B. BACKGROUND

During World War I, military art directed its efforts at developing principles of mobile actions and new forms of flanking attacks, abandoning the search for methods for frontal penetration of defenses. In solving the breakthrough problem, the Germans revealed their years of pre-planning of offensive operations in the first years of the Second World War. The German solution included surprise and intensity in the initial strike, the use of tank troops in close coordination with aviation, and the creation of heavy, localized superiority of forces over the defending enemy on the axis of the breakthrough. [Ref. 1]

C. THE RATIONALE FOR THE GERMAN ROLE MODEL

In any situation where the opposing sides are more or less equal technologically and numerically, the side more likely to prevail is the side with the more astute concepts of warfare. There is a rich history of cases where superior operational prowess has even compensated for notable deficiencies in numbers. The German Army and its methods of

command and control are an excellent example of this superior operational prowess. On the eve of the German attack in 1940, France and its allies looked substantially better than Germany by static measures of military capability (particularly manpower and tanks). France's forces promptly collapsed under the German *Blitzkrieg* and the superior tactical proficiency of the German Army. [Ref. 2] As a result of this and other successes, the German Army has become the subject of many books and articles and is worthy of continuing study.

1. Russian Thinking On German Tactics

The Soviets developed a deep admiration for the creative ability of German command and control and German aggressiveness on the battlefield. The Soviets were so impressed with the Germans that they discounted the study of the Anglo-American armed forces, almost with disdain, as shown by the following:

> In order to attain decisive goals, the fascist German command created powerful groupings and a multiple superiority in forces on the axes of the main strikes. Tank groups (armies) were in the first echelon on these axes, and their purpose was to attack constantly and swiftly toward the rear. Use of mobile troops with air support made it possible to achieve a high rate of advance (averaging 10-15 km per day). The strategic offensive operations of the Anglo-American armed forces were based on successive displacement of the enemy from the lines he occupied by means of frontal offensives. This is why there were no brilliant examples of a major encirclement (save for the Ruhr operation). The average rate of advance of Allied armies in Europe was not more than 5-8 km per day. [Ref. 3]

The Soviets were equally impressed with the Luftwaffe in air operations over Mother Russia. The near-total devastation wrought upon the Soviet Air Force by the Luftwaffe during the opening days of Operation Barbarossa has had a commanding influence on subsequent planning of Soviet air operations to the present.

2. Winston Churchill and the German War Machine

When the *Blitzkrieg* was in its fifth day in the West, Churchill sent Roosevelt a cable that commented on the "astonishing swiftness" of the German conquest of Europe [Ref. 4]. Later a Roosevelt-Churchill meeting scheduled for the spring of 1941 never took place because of the development of too many crises to permit Churchill time for talks. The German *Blitzkrieg* would appear more devastating and irresistible than

ever, and would later burst through the mountain passes of Yugoslavia and then turn into Greece, as Churchill had predicted it would [Ref. 5]. Churchill's great respect for the German ground forces grew from an appreciation for the quality of their training. He knew that the British forces lacked the quality to equal the German forces in an open engagement on land [Ref. 6]. Though lacking in admiration for Germany, Churchill had a deep esteem for the abilities of the German Army and its innovative doctrine and methods of command and control.

3. General Montgomery's View of the German Army

Montgomery had a deep respect born of hatred for the German Army. The memory of Dunkirk would rankle the General to the very last days of the Second world War. It was his sincere desire to avenge Dunkirk that made Montgomery such a ruthless army commander. The twenty-two days of fighting between 10 May and 1 June 1940 would drive home every tenet of his existing military philosophy. Montgomery felt that to face troops as resourceful and efficient as the Germans, neither the doggedness of World War One soldiery nor the well-intentioned camaraderie of the English officer corps would be sufficient. He believed many hundreds of thousands of British and Empire soldiers would have to be killed, wounded or taken into captivity before a commander would be appointed who was capable of forging a British army that could face, let alone challenge, its German counterpart in battle. [Ref. 7]

Montgomery's appreciation for the training, leadership and aggressiveness of the German officer corps was reflected in a conversation with a British lieutenant colonel. Montgomery had relieved the lieutenant colonel of his command. After being dismissed the lieutenant colonel reproved Montgomery by saying:

> Sir, I think this is unreasonable. I am very highly trained. For the last ten years I have spent two or three evenings a week, practically every week-end, and every year a full summer camp with my battalion learning how to do my job.

To which Montgomery replied:

> I fully appreciate that, but within a month or two you are going to meet in battle a German lieutenant colonel who for the last thirty years has given all his time every day in every week in every month learning his job and you will not be able

to take him on. You have got magnificent soldiers under you, but I think they must be given a chance under a better commanding officer. [Ref. 8]

Montgomery felt it was leadership that was going to pull the British Army through. An officer had to prove his ability if he was to face an enemy as tough as the German Army had already proved itself to be. [Ref. 9] At the time one only had to look at the example of German military success in Poland to see Montgomery's point [Ref. 10].

4. Paul Kennedy

Paul Kennedy, a research assistant to Liddell Hart, had a profound understanding of the German Army of the Second World War. He made the following observation in his book, "The Rise and Fall of the Great Powers":

> While the "phony war" did not put Germany's economic vulnerability to the test, it did allow Germany to perfect those elements of national strategy at which the *Wehrmacht* was so superior--that is, operational doctrine, combined arms, tactical air power, and decentralized offensive warfare. The Polish campaign in particular confirmed the efficacy of *Blitzkrieg* warfare, exposed several weaknesses (that could then be corrected), and strengthened German confidence in being able to overrun foes by rapid, surprise assaults and the proper concentration of aerial and armored power. The best example of the superiority of German military doctrine and operational tactical ability came in the French campaign of May-June 1940, when the larger but less organized Allied infantry and armored forces were torn apart by Guderian's clusters of tanks and motorized infantry. In all of the encounters, the attacker enjoyed a considerable air superiority. Unlike the 1914-1916 battles, therefore, in which neither side showed much skill in grappling with the newer condition of warfare, these 1940 campaigns revealed German advantages. [Ref. 11]

D. THE NATURE AND THE THEORY OF WAR

The nature and the theory of war are the foundation upon which campaigns are waged. To bring better appreciation to the reader, this thesis seeks to understand war as broadly as possible and the application of war at the divisional level and below. The nature of war and definitions and concepts affecting the tactical level also will be illustrated, to define warfare at the tactical level. The nature of war describes the characteristics, problems and demands of war. The theory of war is based on the

understanding of its nature [Ref. 12], and it is from here that doctrine is derived, and subsequently, command and control.

1. The Nature of War

a. Defining War

War is a state of hostilities that exists between or among nations, characterized by the use of military force. The essence of war is a violent clash between two hostile, independent, and irreconcilable wills, each trying to impose itself on the other. [Ref. 13] The object of war is to impose one's will on one's enemy. The means to that end is the organized application or threat of violence by military force. [Ref. 14]

b. Friction and Resistance

> Everything in war is simple, but the simplest thing is difficult. The difficulties accumulate and end by producing a kind of friction that is inconceivable unless one has experienced war. -Carl von Clausewitz

War appears a simple enterprise. But in practice, because of the countless factors that impinge upon it, the conduct of war becomes extremely difficult. These factors collectively have been called friction. Friction is the force that resists all action. It makes the simple difficult and the difficult seemingly impossible. [Ref. 15] The enemy seeks to resist while imposing his will on his opponent. It is the dynamic interplay between wills that makes war difficult and complex. In this environment, friction abounds. [Ref. 16] Friction is evident in the command and control process, as when staffs argue, plan poorly or simply fail to send out clear orders fast enough. The command and control process, as with any activity, must have some internal friction. Any process between any two elements is an occasion on which friction can degrade the activity's effectiveness. As more elements interact, the more the occasion for friction. A battalion will have more friction than a squad, and a division more than a battalion because there are more planes, more orders, more communications, etc. Thus, command of layered forces inherently has major degradations of theoretical (designed)

combat power. This due to the large amount of actions taking place when command activates its combat power. [Ref. 17]

While friction may be induced by enemy action, the major cause of reduced performance is enemy resistance. If one thinks of resistance as reduced effectiveness caused by the enemy's fire--an external cause--and friction as self-induced, or internally caused reduction in effectiveness, then friction is clearly defined. As the formulas show:

- Enemy activity ⇒ "**resistance**" ⇒ an external force that resists all friendly action's effectiveness.
- Own activity ⇒ "**friction**" ⇒ an internal force that diminishes own effectiveness. [Ref. 18]

Chapter III gives a structured analysis of the German command and control system. As an example of his understanding of friction, Rommel places himself up front with a tank company. Why was Rommel, the division commander, up front with a tank company and not in control of the division? The answer lies with the German command and control structure and the decentralization of command. Troops go to ground (or stop) due to the fog of war. By being up front, Rommel mastered the paralyzing effect of internal friction, enemy resistance and uncertainty.

c. Uncertainty

Uncertainty is singled out because it is such a pervasive phenomenon of war. All actions in war take place in an atmosphere of uncertainty--the fog of war. Uncertainty pervades battle in the form of unknowns about the enemy, about the environment, and even about the friendly situation. While one tries to reduce the unknowns by gathering information, it must be realized that the fog of war cannot be eliminated. The very nature of war makes complete certainty impossible; all actions in war will be based on incomplete, inaccurate, or even contradictory information. [Ref. 19] By its nature, uncertainty invariably involves the estimation and acceptance of risk. Risk is inherent in war and is involved in every mission. Risk is

related to gain; normally, greater potential gain requires greater risk. Part of risk is the ungovernable element of chance. The element of chance is a universal characteristic of war and a continuous source of friction. Chance consists of turns of events that cannot reasonably be foreseen and over which opposing forces have no control. The uncontrollable potential for chance alone creates mental uncertainty, and indecision, i.e., psychological friction. [Ref. 20]

The fog of war adds fuel to the uncertainty of battle. This requires commanders to be decisive, to have initiative and to be given freedom of action to accomplish their mission according to the next senior's intent. Such was the command and control thought process that was used by the German Army at the levels of operational art and tactics during the Second World War.

d. Fluidity and Tempo

Like friction and uncertainty, fluidity is an integral attribute of the nature of war. Each episode in war is the temporary result of a unique combination of circumstances, requiring an original solution. But no episode can be viewed in isolation. Each merges with those that precede and follow it--shaped by the former and shaping the conditions of the latter--creating a continuous, fluctuating fabric of activity replete with fleeting opportunities and unforeseen events. Success depends in large part on the ability to adapt to a constantly changing situation. [Ref. 21]

Clearly there will be times when it is advantageous to push men and equipment to the limit, although it is physically impossible to sustain a high tempo of activity indefinitely. Thus, the tempo of war will fluctuate--from periods of intense activity to periods in which activity is limited to information gathering and replenishment. Darkness and weather can influence the tempo of war but need not halt it. A competitive rhythm will develop between the opposing wills, with each belligerent trying to influence and exploit tempo and the continuous flow of events to suit his purposes. [Ref. 22] This understanding of tempo, that carried over into the German command and control and rhythm, caused Dr. Theodore von Karman to make the following comment:

> See here, I was a lieutenant in the Austro-Hungarian general staff, and it was always the same. The problems were different, the times were different, the music was different, but the melody, the melody, it was always the same.

In other words, this tempo, or melody as the doctor puts it, was well recognized by German command and control as a weapon to keep the enemy off balance and keep him in a state of disorder.

e. Disorder

In an environment of friction, uncertainty, and fluidity, war gravitates naturally towards disorder. Like the other attributes of the environment of war, disorder is an integral characteristic of war; one can never eliminate it. In the heat of battle, plans will go awry, instructions and information will be unclear and misinterpreted, communications will fail, and mistakes and unforeseen events will be commonplace. It is precisely this natural disorder that creates the conditions ripe for exploitation by an opportunistic will. [Ref. 23]

By historical standards, the modern battlefield is particularly disorderly. While past battlefields could be described by linear formations and uninterrupted linear fronts, we cannot think of today's battlefield in linear terms. The range and lethality of modern weapons have increased dispersion among units. In spite of communications technology, this dispersion strains the limits of control. The natural result of dispersion is unoccupied areas, gaps, and exposed flanks that can and will be exploited, blurring the distinction between front and rear and friendly- and enemy-controlled areas. [Ref. 24]

f. The Human Dimension

> War is the severest test of the spiritual and bodily strength. In war, character outweighs intellect. Many stand forth in the field of battle who in peace would remain unnoticed. The first demand in war is decisive action. Everyone, the highest commander and the most junior soldier, must be aware that omissions and neglects incriminate him more severely than the mistakes in choice of means.
>
> General Beck

The human dimension is central in war because war is a clash between opposing human wills. It is an extreme trial of moral and physical strength and stamina.

Any view of the nature of war would hardly be accurate or complete without consideration of the effects of danger, fear, exhaustion, and privation on the men who must do the fighting. [Ref. 25] No degree of technological development or scientific calculation will overshadow the human dimension. Any doctrine that attempts to reduce warfare to ratios of forces, weapons, and equipment neglects the impact of the human will on the conduct of war. [Ref. 26]

g. Violence and Danger

War is a violent enterprise and danger is a fundamental characteristic of war. Since war is a human phenomenon, fear--the human reaction to danger--has a significant impact on the conduct of war. Experience under fire generally increases courage, as can realistic training by lessening the mystique of combat. Strong leadership, as understood by Montgomery to be used as a weapon against the Germans, earns the respect and trust of subordinates and can limit the effects of fear [Ref. 27]. It is through realistic training, well thought-out doctrine and strong leadership that the initial phenomenon or the experiences of war lessen the dislocating effect that induces fear caused by danger. Even so, Rommel noted, fresh troops, not accustomed to war, no matter how well trained in peacetime, were confused and disoriented until first blooded. However, a few troops with combat experience had a settling effect on the unit as a whole.

h. Moral and Physical Forces

> In war, opportunities to exploit a moral advantage will arise three times as often as opportunities to exploit a material advantage. Napoleon

War is characterized by the interaction of both moral and physical forces. The physical characteristics of war are easily seen, understood, and measured: hardware, technology, physical objectives seized, force ratios, losses of material or life, terrain lost or gained, prisoners or material captured. The moral characteristics are less tangible. (The term *moral* as used here is not restricted to ethics, although ethics are an important part, but pertains to those forces of psychological rather than tangible nature, to include the mental aspects of war.) Moral forces are difficult to grasp and impossible to quantify.

One cannot easily gauge forces like national and military resolve, national or individual conscience, emotion, fear, courage, morale, leadership, and esprit. Yet moral forces exert a greater influence on the nature and outcome of war than do the physical forces. This is not to lessen the physical forces, for they can have a significant impact on the moral. For example, the greatest effect of fire on the enemy is generally not the amount of physical destruction it causes, but the effect of the physical destruction on his moral strength. [Ref. 28]

i. The Art Verses the Science of War

In 1926 J. F. C. Fuller published *The Foundations of the Science of War*. War was actually a science, he argued, and should be studied as such (the Soviet's view of war generally reflects Fuller on this point). In the book he proceeded to lay the foundation for such a study. Wars were conducted within three spheres: mental, moral and physical. Each sphere was built around three primary elements that in turn were influenced by certain conditions. More than a science (due to the human dimension), war was also an art, a fact that can be discovered through the intelligent study of military history. [Ref. 29]

While there is no doubt that the science of war has a substantial impact on all levels of war, the two, the science and the art, are very much interrelated and difficult to separate, like theory and practice. Various aspects of war, particularly its technical aspects, fall principally in the realm of science, that can be described as the methodical application of the empirical laws of nature. The science of war includes those activities directly subject to the laws of physics, chemistry, and like disciplines. For example, the application of fires, the effects of weapons, and the rates and methods of movement and resupply are amenable to scientific study and quantitative plans and actions. Owing to the vagaries of human behavior and countless other intangible factors, however, that contribute to it, the skillful conduct of war is artistry, not reducible to formulae, algorithms, universal laws, or riskless predictions. The science of war assists, but does not replace military judgement. The impact of moral forces, the influence of chance, and other similar factors overwhelm any "scientific" methodology or approach to

war. It can be concluded that the conduct of war is artistic activity of human creativity and intuition empowered by the strength of human will supplemented by knowledge and experience, and the acute (that is to say, scientific) study of it. The art of war requires the intuitive ability to grasp the essence of a unique battlefield situation, the creative ability to devise a practical solution and the strength of purpose to execute the act. [Ref. 30]

Simply defined, the art of tactics involves the skillful employment of troops and equipment or combat power in battle. The science of tactics, therefore, is the structured knowledge of the subject based on empirical data or experience that aids successful practice. It is from this point of view, i.e., the science of war, that this thesis draws on the German experience of the Second World War to comprehend the applicable lessons for understanding the development of modern warfare.

2. The Theory of War

a. The Offense, the Defense and the Culminating Point

> The attack suits the soldier better than defense. All war-like and fighting virtues such as daring, decision, courage, offensive spirit, destructive will and self-confidence are awakened by, and take their full value from, offensive action. These virtues repel influences such as change, incertitude, doubt, irresolution, hesitancy and the unforeseen which affect the conduct of battle and the conduct of war. But also they make their success questionable. A Senior German General

The offense contributes striking power. The offense generally has as its aim some positive gain. It is through the offense that one seeks to impose some design on the enemy. The defense, on the other hand, contributes resisting power the ability to preserve and protect oneself. The defense generally has a negative aim, that of resisting the enemy's will. [Ref. 31] The defense is inherently the stronger form of combat. Were this not so, there would be no reason ever to assume the defense to compensate for one's weakness. The offense, with its positive aim, would always be preferable. But in fact, if one is weaker than his enemy, one assumes the defensive to compensate for that weakness. Similarly, if one were to mount an offense to impose one's will, one must develop enough force to overcome the inherent superiority of the

enemy's defense. [Ref. 32] While the defense is the stronger form of combat, the offense is the preferred form, for only through the offense can one truly pursue a positive aim. One resorts to the defense when weakness compels. [Ref. 33]

While opposing forms, the offense and defense are not mutually exclusive. In fact, they cannot exist separately. For example, the defense cannot be purely passive resistance. An effective defense must assume an offensive character, striking at the enemy at the moment of his greatest vulnerability. It is "not a simple shield, but a shield made up of well-directed blows." The truly decisive element of the defense is the counterattack [Ref. 34], a concept that was understood by Moltke (the elder). The offense cannot sustain itself indefinitely. It becomes necessary to halt the offense to replenish and the defense automatically takes over. The requirement to concentrate forces at the focus of effort for the offense necessities assuming the defensive elsewhere. [Ref. 35]

The concept of the culminating point completes the understanding of the relationship between the offense and defense. Since one cannot usually be superior everywhere, one tries to be offensive at the critical point, and defensive elsewhere. Not only can the offense not sustain itself everywhere; it cannot sustain itself indefinitely and generally grows weaker as it advances. Certain moral factors, such as morale or boldness, may increase with a successful attack, but these generally cannot compensate for the physical losses involved in sustaining an advance in the face of resistance. One advances at a cost--lives, fuel, ammunition, physical and sometimes moral strength--and so the attack becomes weaker over time. Eventually, the superiority that allowed one to attack and force the enemy to defend in the first place dissipates and the balance tips in favor of the enemy (as did the German Army and its thrust into Mother Russia). This is the culminating point. It is precisely at this point that the defensive element of the offense is most vulnerable to the offensive element of the defense, the counterattack. [Ref. 36] It was at this point, when the superior Russian tanks proved to be the dominate factor, that the German Army reeled backward under the very much improved and massive blows of the Russian artillery. These defeats had a profound effect on

German command and control. This subject is explored more in Chapters V and VI and shows the rethinking of German defensive doctrine and the effects on employing supporting arms.

The relationship between offense and defense exists simultaneously at all levels of war. One may employ a tactical defense as part of an offensive campaign (as did the Germans with their *Keil und Kessel* or wedge and caldron tactics), availing oneself of the advantages of the defense tactically while pursuing an operational offensive aim. [Ref. 37]

b. Style of Warfare

Just as there are two basic forms of combat (offense and defense), there are two essential components: fire and movement. One cannot exist without the other, for fire and movement are complementary and mutually dependent (and hence there is a compelling need for coordination and balance between all combat arms). It is movement that allows one to bring fires to bear on the enemy just as it is the protection of fires that allows one to move in the face of the enemy. It is through movement that one explores the effects of fires. It is the destructive force of fires that adds menace to one's movement. [Ref. 38] These two components provide the foundation for two distinct styles of warfare: an attrition style, based on firepower, and a maneuver style, based on movement. The different styles can exist simultaneously at different levels. [Ref. 39]

Warfare by attrition seeks victory through the cumulative destruction of the enemy's material assets by superior firepower and technology [Ref. 40]. In contrast, warfare by maneuver stems from a need to circumvent enemy strength and attack it from a position of advantage rather than meet it directly. To win by maneuver, one cannot substitute numbers for skill. Maneuver thus makes a greater demand on military judgement. Potential success by maneuver--unlike attrition--is often disproportionate to the effort made. Maneuver incompetently applied carries with it a greater chance for catastrophic failure, while attrition is inherently less risky but more costly. [Ref. 41]

c. Concentration and Speed

Concentration is the convergence of effort. It is the means by which one develops superiority at the decisive time and place. Concentration does not apply only to combat forces. It applies equally to all available resources: fire, aviation, the intelligence effort, logistics, and all other forms of combat support and combat service support. Similarly, concentration does not apply only to the conduct of war, but also to the preparation for war. [Ref. 42] Effective concentration may achieve decisive local superiority for a numerically inferior force. The willingness to concentrate at the decisive place and time necessitates strict economy and the acceptance of risk elsewhere and at other, perhaps later, times. [Ref. 43] As an excellent example of this, during the German advance into Russia, Hitler diverted forces away from the Central Army Group to deal with Soviet forces in the Ukraine at a critical time on it's march on Moscow. This diversion was costly in terms of resources and time to the German Army. It was the main factor in the German Army failing to take Moscow, the German Army's main objective.

Since war is fluid and opportunities fleeting, concentration applies to time as well as to space. One must concentrate not only at the decisive location, but also at the decisive moment. Furthermore, physical concentration--massing--makes one vulnerable to enemy fires, necessitating dispersion. Thus, a pattern develops: disperse, concentrate, disperse again. [Ref. 44]

Speed is rapidity of action. Like concentration, speed applies to both time and space. Like concentration, it is relative speed that matters. Speed over time is tempo--the consistent ability to operate fast. Speed over distance, or space, is velocity--the ability to move fast. Superior speed allows one to seize the initiative and dictate the terms of combat, forcing the enemy to react to one's wishes. Speed provides security. It is a prerequisite for maneuver and for surprise. Besides, speed is necessary to concentrate superior strength at the decisive time and place. [Ref. 45]

The combination of concentration and speed is momentum. Momentum generates impetus. It adds "punch" or "shock effect" to one's action [Ref. 46].

It was this shock effect that allowed the Germans to make the phenomenal gains they did in Poland, France and Russia in relatively short periods of time. The German Army would drive boldly into their enemy's rear area to destabilize or destroy its opponent's command and control process. This boldness coupled with the German method of command and control allowed the Germans to make decisions in a shorter time than their opponents, creating surprise.

d. Surprise and Boldness

Two additional considerations that are significant as multipliers of combat power are surprise and boldness. Surprise implies striking the enemy at a time or place or in a manner for which he is unprepared. It is not essential that one take the enemy unaware, but only that the enemy become aware too late to react effectively. [Ref. 47] One must realize that surprise is difficult to achieve and easy to lose. Its advantages are only temporary and must be exploited quickly. [Ref. 48]

Boldness is a multiplier of combat power in much the same way as surprise. Boldness is a genuinely creative force. Boldness is superior to timidity and is at a disadvantage only in the face of calculating patience that allows the enemy to move forward inexorably before striking--a form of boldness in its own right. Boldness must be tempered with judgement lest it become recklessness. [Ref. 49]

e. Exploiting Vulnerability and Opportunity

It is not enough simply to generate superior combat power. One can conceive easily of superior combat power dissipated over several unrelated efforts or concentrated on some unimportant objective. To win, one must concentrate combat power toward a decisive aim. [Ref. 50] One should generally avoid the enemy's front, where his attention is focused and he is strongest, and seek out his flanks and rear, where one also can cause the greatest psychological damage. One also should strike at that moment in time the enemy is most vulnerable. [Ref. 51]

In reality, the enemy's most critical vulnerability will rarely be obvious, particularly at the lower levels. One may have to adopt the tactics of exploiting all vulnerabilities until the decisive opportunity is uncovered. [Ref. 52] Decisive

results in war are rarely the direct result of an initial, deliberate action. Rather, the initial action creates the conditions for subsequent actions that develop from it. As the opposing wills interact, they create various, fleeting opportunities for either enemy. Such opportunities are often born of the disorder that is natural in war and should be exploited. They may be the result of one's own actions, enemy mistakes, or even chance. By exploiting opportunities, one creates more opportunities for exploitation. It is often the ability and the willingness to ruthlessly exploit these opportunities that generate decisive results. [Ref. 53]

f. The Levels of War and the Spectrum of Conflict

Each broad division of war provides a different perspective. The view one sees from the strategic perspective of war may be altogether different than the view from the tactical or the operational perspective of war, although all views, in the context of the appropriate perspectives, could be accurate. The three perspectives are not interchangeable, but do overlap, and one must understand their differences to understand the nature of war. The view from each of the three perspectives of war--strategic, operational and tactical--may also change depending on where one is in the spectrum of the intensity of conflict. [Ref. 54] At one end are conflicts of low intensity in which the application of military power is restrained and selective. The other end represents conflicts of high intensity, such as nuclear war. The place of a specific conflict on the spectrum depends on several factors. Among them are political objectives, military means available, national will, and density of fighting forces or combat power on the battlefield [Ref. 55], to include the lethality of weapons systems.

g. Tactics, Operational Art, and Strategy

The effects of different weapons determine tactics which are simply the correct application of combat power to defeat the enemy. The operational art can be thought of as the movement and placement of combat potential. It deals with the skillful positioning of force in time and space to deliver combat power at the tactical level. As such it constitutes a middle area between tactics and strategy and involves winning campaigns. Strategy concerns itself with winning wars in terms of employing political,

economic, psychological and military force. At the strategic level, time and space factors lessen somewhat in importance. The strategist is concerned with the overall balance of forces in relation to the economic, psychological and political (both foreign policy and domestic) considerations that bear. [Ref. 56]

(1) Tactics. FMFM 1 describes tactics as follows:

> Activities at the tactical level of war focus on the application of combat power to defeat an enemy in combat at a particular time and place. Tactics can be thought of as the art and science of winning engagements and battles. It includes the use of firepower and maneuver, the integration of different arms, and the immediate exploitation of success to defeat the enemy.

FMFM 1 goes on to say the tactical level also includes the technical application of combat power, that consists of those techniques and procedures for accomplishing specific tasks within a tactical action. These techniques and procedures deal primarily with actions designed to enhance the effects of fires or reduce the effects of enemy fires--methods such as the call for fire, techniques of fire, the technical operation of weapons and equipment, or tactical movement techniques. This point is made to draw the distinction between tactics, which are the product of judgement and creativity, and techniques and procedures, which are generally performed by repetitive routine. [Ref. 57]

(2) Caesar at the Tactical Level. The Roman Legions, unlike the Greeks, controlled their forces through decentralization of command at the lowest levels that allowed small units the ability to react to the changes in a dynamic environment. (This concept is also the basis used by the Germans for their command and control.) The Romans arrived at an extraordinarily effective solution by devising formations that could, and did, fight without need for overall direction. The outstanding fact is that the legion was organized into compact, permanent units--century, maniple, or cohort, according to the period in question--each of which had its own commander, bugler, and standard. The latter was no improvised contraption for issuing ad hoc signals but a permanent fixture, of symbolic as well as practical use, that made it possible to issue many different orders. The combination of proper training, bugles, and standards (flag-like symbols) made it

possible first to call the men's attention and then to issue an exact order. [Ref. 58]

Even more crucial than the technical means that enabled subordinate commanders to exercise proper control over their men was the checkerboard formation itself. By leaving open room for maneuver and allowing the centurions to see each other's units, the formation enabled them to come to each other's aid. There existed a well-rehearsed repertoire of tactical moves from the *cuneus* (wedge) to the *sera* (saw), capable of being carried out at a moment's notice. Roman legions in battle scarcely needed a commander to gain victory; time and again the centurions, or else military tribunes, field-grade officers all, who "knew what to do" and "judging on the spur of the moment" came to their comrades' aid, or closed a legion's shattered ranks, or took several maniples and, apparently acting on their initiative, carried out an outflanking movement. [Ref. 59]

The Roman Legion's solution to the problem of battlefield control was to simplify it by means of standardized tactical drill coupled with a deployment that gave subordinate commanders at the lowest levels the means, as well as the opportunity, of exercising their initiative and supporting each other. These factors together, coupled with the fact that he was not in direct charge of any subordinate unit, untied the hands of the commander-in-chief; for the first time he was capable of free movement around the battlefield. [Ref. 60]

One of the best instances of sustained battlefield command is the battle of Ruspina, 47 B.C., when Caesar faced the Pompey's forces under Labienus in Africa. Caesar, marching out from camp over perfectly flat terrain, was informed by his scouts that the enemy was in sight. At the same moment a cloud of dust in the distance also signified their presence. He immediately rode ahead with a small party, sighted the enemy, and ordered a single line of battle to be formed. He next instructed the wings to take care not to be enveloped, a necessary precaution since that was just what the enemy with his superior cavalry proceeded to do. As the two armies come closer together, Caesar, from the point at which he was stationed, had the order passed down the ranks:

that no soldier should advance more than four feet in front of the standards. After some skirmishing on both flanks, the enemy by virtue of his superior numbers was able to surround Caesar's army. In response, Caesar, with his standards, ordered every alternate cohort to turn about, so that half his force now faced the rear, as he did himself. With a volley of missiles Caesar's troops broke through the encircling ring of enemy soldiers. Still well in hand, they retired to find that their comrades behind had scattered the enemy also. Deciding to call it a day, Caesar started marching back to camp while still maintaining battle formation. [Ref. 61]

The use of permanent, well-organized, integrated units; an efficient system of tactical communications at the lowest level, that of the century, maniple, and cohort; deployment that enabled subordinate commanders to support each other and to make use of their initiative; and the consequent freedom enjoyed by the commander in chief--such were the elements of the tactical command system that for hundreds of years turned the Legions into the symbol of victory in the field. Also of great importance was the standardized repertoire of tactical movements carried out by the various units, through in this case it is possible to argue that the very element that contributed to success also limited the Legion's effectiveness when it came to fighting in unfamiliar terrain such as the deserts of Persia or the forests of Germany. Still, it was precisely the stability and iron discipline of the Roman Army as a whole (like the German Army) that made tactical flexibility and the exercise of initiative at the lowest level possible. Only under conditions of long-term stability was it possible to create a body of officers who, as one author puts it, acted with that "impersonal efficiency" characteristic of the Romans, knew what to do without having to be told, and were capable of passing that knowledge down to the next generation. [Ref. 62]

(3) Operational Art. FMFM 1 describes the operational level as follows:

> The operational level of war links the strategic and tactical levels. It is the use of tactical results to attain strategic objectives. The operational level includes deciding when, where, and under what conditions to engage the enemy in battle--and when, where and under what conditions to refuse battle--with reference to higher aims. Actions at this level imply a broader dimension of time and space than do tactics. As strategy deals with wars and tactics with battles and

> engagements, the operational level of war is the art of winning campaigns. Its means are tactical results, and its end is the military strategic objective.

The operational level is the pivotal location between strategy and tactics. Simply put, the commander's basic mission at this level is to determine the sequence of actions most likely to produce the military conditions that will achieve the strategic goals. The operational commander must be interacting constantly with the strategic level even as he gauges his adversary and determines how to use tactical forces to accomplish that sequence of actions. It is this interaction that makes strategy the key to the operational level of war. [Ref. 63]

(4) Moltke (the elder) at the Operational Level. "The art of winning campaigns" is the standard definition of operations. Helmuth Graf von Moltke, Chief of the German General Staff 1858-1888, had a general concept of how he wanted operations to go, apart from the accidents of particular dispositions of forces, the terrain, and so on. Moltke would then adopt his general scheme to the particulars of a given situation. Moltke, however, founded his system of operations on concrete aspects of the military environment in which he operated. [Ref. 64] Moltke operated in an age of increased firepower, which made the tactical defensive very strong. Therefore, the strength of the tactical defense became an element of his system of operations. Moltke built much of his system around the necessity of avoiding frontal attacks on his enemies insofar as possible. Instead he used flanking attacks. At the same time, Moltke recognized that the strength of the enemy's tactical defense made isolated portions of his forces relatively less vulnerable to enemy attacks. Therefore he could afford to maneuver his forces more boldly--while he was seeking for an opportunity to flank the enemy forces. Increased strength of the tactical defense could work for the attacker as well as the defender. [Ref. 65]

The increase in the strength of the tactical defense led Moltke to "offset the firepower of his opponent by concentrating superior firepower and general tactical pressure through a converging attack on front and flank". In other words, Moltke would avoid purely frontal assault. The enemy would most likely discover a flanking

movement initiated when the armies were already in contact. It is easy to react to a flanking attack discovered in time--bending back one's own flank usually will suffice. Schemes to trap and destroy the flanking force also were used often. Therefore, Moltke realized that his flanking attacks would have to come from beyond the enemy's reconnaissance zone, from widely separate forces converging on the battlefield. Another way to put it is that flank attacks on a tactical scale of time and distance would not work, but flanking movements on an operational scale of time and distance might work. [Ref. 66] The increased strength of the tactical defensive would in turn protect these widely separated converging forces from enemy counteraction. If the enemy did discover Moltke's flanking units, chances were that the unit could maintain itself until help arrived. This increased strength also meant that pursuit after the battle became more difficult. [Ref. 67]

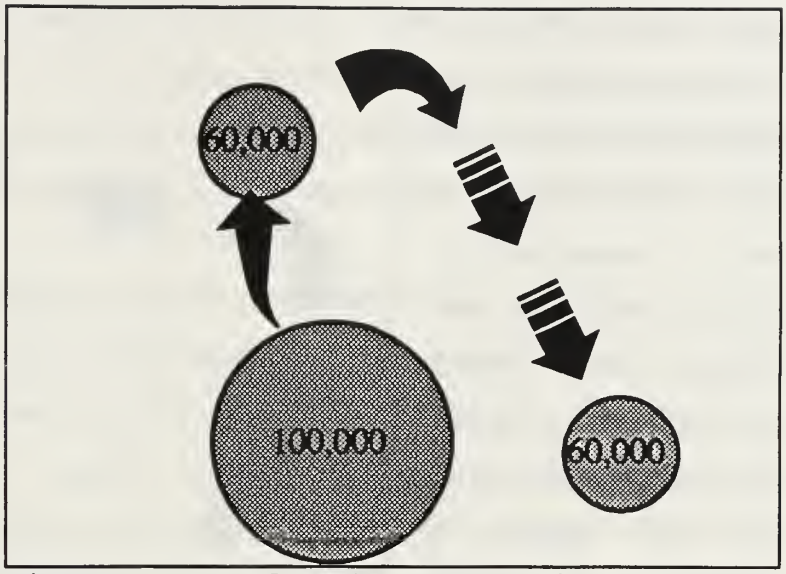

Figure 1 Napoleon's attack with 100,000.

The difficulty of swiftly achieving a decisive victory made for the increased significance of the "exterior lines" and tended to vitiate the advantage that "interior lines" had conferred in the Napoleonic campaigns. Napoleon had been able to act on the assumption that an army of 100,000 men--particularly under his leadership--in the midst of two others of 60,000 each, could successively defeat and destroy them in detail (see Figure 1). By the time of Moltke the probability had become that the 100,000 would be caught and defeated between the two before it could eliminate either of them (see Figure 2). [Ref. 68] In military parlance, interior lines are those that lie along the inside portion of an arc, whereas exterior lines are those that lie along the

outside portion of an arc. The side that occupies the interior lines can move across the interior of the arc to concentrate its forces, whereas the side deployed along exterior lines must move around the outer circumference of the arc (see Figure 3). According to military tradition, the army operation along interior lines has an advantage. [Ref. 69]

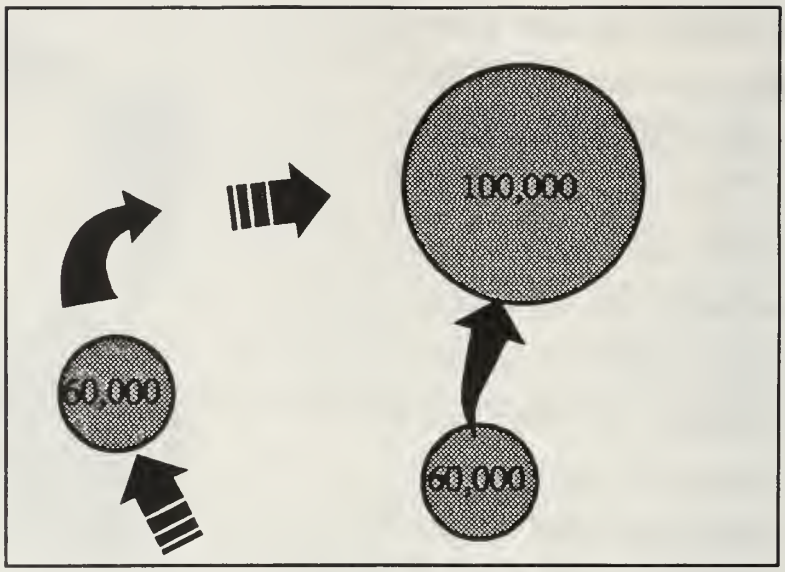

Figure 2 Moltke's attack with 120,000.

Railroads and improved marching techniques (marching the army corps by parallel roads, rather than stringing them out like a long snake on a single road) made rapid deployments on exterior lines easier to achieve. Moltke's general operational system made rapid deployments along exterior lines desirable. Moltke's recipe for victory, then, involved that same rapid deployment along exterior lines, exploiting railroad movement. The different parts of the army would than advance on the enemy, who would most likely concentrate in the old fashion. Moltke then could fix the enemy frontally by using a

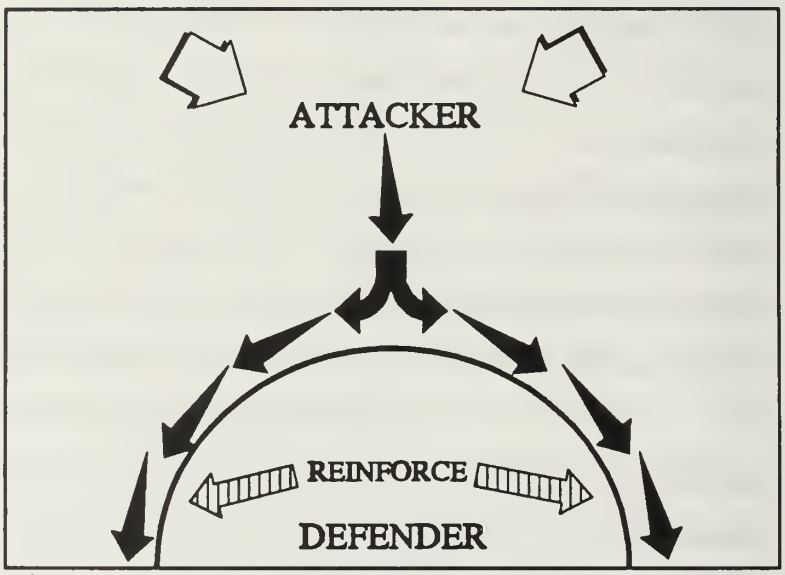

Figure 3 The interior lines of an arc.

portion of his force, as he coordinated the movement of the remaining portion of his forces onto the enemy flank. If the enemy advanced to try to destroy one of the converging elements, that element could most likely maintain itself, thereby fixing the enemy frontally, while the unengaged forces maneuvered for the enemy flank. [Ref. 70]

The outcome of battles is always somewhat unpredictable. Moltke's own forces would make mistakes and intelligence concerning enemy forces would vary in quality. Moltke had to adapt to these particulars, and he did. He made these adaptations in light of his general conception of how to win a campaign. [Ref. 71] Moltke built his system by avoiding frontal attacks on his enemies and solved "the operational problem" and is, therefore, given credit for originating the concept of operational art in the 19th century. Further study of Moltke also reveals the "idea or thinking" of decentralization of offensive operations at the tactical level, an important concept in understanding the German command and control structure and German matrix organization of forces for combat in the Second World War.

(5) Strategy. FMFM 1 describes strategy as follows:

> Activities at the strategic level focus directly on national policy objectives. Strategy applies to peace as well as war. Within strategy we distinguish between *national strategy*, which coordinates and focuses all the components of national power to attain the policy objective, and *military strategy*, which is the application of military force to secure the policy objectives. Military strategy thus is subordinate to national strategy. Strategy can be thought of as the art of winning wars. Strategy establishes goals in theaters of war. It assigns forces, provides assets, and imposes conditions on the use of force. Strategy derived from national policy must be clearly understood to be the sole authoritative basis of all operations.

Strategic guidance is the link between the highest level of war and the operational commanders. This guidance should, in theory, contain a balanced blend of ends (objectives), ways (concepts), and means (resources). The proper blending of these interdependent elements has always been a difficult process. [Ref. 72]

The commanders and staff at the strategic level must recognize that an army is of little value in the field unless there are wise councils at home. Germany's operational and tactical brilliance in World War II is an example concerning the

operational level of war. This brilliance was no substitute for a sound and coherent strategy and Germany was defeated primarily because Hitler's strategic objectives far exceeded his military capabilities. [Ref. 73]

(6) Hitler and the Strategic Level. Hitler failed at the strategic level. He was not able to stand up to the analysis or self-examination that was characteristic of the German Army. The General Staff, prior to Hitler (who virtually destroyed it), had a marked characteristic of high professional prestige. The decay of the General Staff begins with the setting up of the High Command of the Wehrmacht (O.K.W.). The command was to co-ordinate the operations of all fighting forces. What was created was a system that put policy and strategy in one lot of hands and responsibility for the separate services in another. This is a weakness because it leaves the separate services out of the policy-making decisions and allows a select few to control and mandate as they see fit. [Ref. 74] There was no forum for self-examination at the top of the German hierarchy.

The vices of Hitler's system were aggravated by his temperament and methods. He tended to choose for the O.K.W. men whom he could dominate and who had neither the will power nor the desire to question his decisions. When they did so they were overborne. He further accentuated the weakness by creating a machinery resembling that of the old military cabinets, that had organizations to provide a royal commander-in-chief with information and supervise the issuing of his orders. When the war spread to a number of fronts, the General Staff's control was confined to certain theaters and the O.K.W. dealt with other theaters directly, without using it as an intermediary. Operations succeeded as well as they did only because a high level of competence was maintained by the staffs of higher formations. [Ref. 75]

The failure of German Army plans to defeat the Soviet Union in a brief campaign of approximately 10-17 weeks, changed the entire dimensions of the war. Strategically, the failure meant that Germany now had to fight on several fronts, the same dilemma they had from 1914-1917. This was a particularly heavy strain for the Luftwaffe, which had its squadrons thinly spread between the West, the East and the Mediterranean.

It also ensured the British Empire's continuing position in the Middle East. The British in the Middle East surely could have been overrun had Hitler dispatched against them one-quarter of the troops and aircraft used for Operation Barbarossa. Instead the British were able to use the Middle East, like the home islands, as a springboard for an enemy counteroffensive in the future. Most important of all was the sheer geographical distances and logistical demands of campaigning hundreds of miles deep into Russia. This undermined the *Wehrmacht's* greatest advantage: its ability to launch shock attacks within limited confines, so as to overwhelm the enemy before German supplies began to run low and its war machine to slow down. In contrast to the stupendous array of front-line strength assembled by Germany and its allies in June 1941, the supporting and follow-on resources were minimal, especially in the light of the poor road system. No thought had been given to winter warfare, since it was assumed that the struggle would be over within three months. German aircraft production in 1941 was significantly smaller than that of Britain or Russia, let alone the United States. The *Wehrmacht* certainly had far fewer tanks than Russia and the supplies of petroleum and ammunition were quickly run down in the extensive campaigning. Even when the Wehrmacht was spectacularly successful in the field--and Stalin's inept deployment orders in the face of impending attack allowed the Germans to kill or capture three million Russians in the first four months of fighting--did not of itself solve the problem. Russia could suffer appalling losses of men and equipment, and cede a million square miles of territory, and still not be defeated. The capture of Moscow, or perhaps even of Stalin himself, might not have forced a surrender, given the country's extraordinarily large reserves. [Ref. 76]

The Germans made grievous political and strategical errors after 1941. These ranged from relatively small-scale decisions, like pouring reinforcements into North Africa in early 1943, just in time for them to be captured, to the appallingly stupid as well as criminal treatment of the Ukrainian and other non-Russian minorities in the USSR, who were happy to escape from the stalinist embrace until checked by Nazi atrocities. It ran from the circumstance of assuming that the Enigma codes could never be broken to the ideological prejudice against employing German women in munitions

factories, when all Germany's enemies willingly exploited that largely untapped labor pool. It was compounded by rivalries within the higher echelons of the army itself, which made it ineffective in resisting Hitler's manic urge for ill conceived offensives like Stalingrad and Kursk. Above all, there was what scholars refer to as the "polycrotic chaos" of rivaling ministries and sub-empires (the army, the SS, the Gauleiter, the economics ministry), that prevented any coherent assessment and allocation of resources, let alone the hammering-out of what elsewhere would be termed a "grand strategy". [Ref. 77]. The German errors in strategy proved to be their Achilles' heel, although German prowess in operations and tactics came close to giving them victory over the Soviet Union by August 1941.

II. THE DEVELOPMENT OF GERMAN DOCTRINE AND GERMAN COMMAND AND CONTROL

A. THE DEVELOPMENT OF GERMAN DOCTRINE/COMMAND AND CONTROL

This chapter sets the historical backdrop for German doctrine and the German style of command and control. The Germans, in Second World War, were able to achieve spectacular tactical successes against superior enemy forces to the point that these successes shocked the World. The German combat superiority was due more to their doctrine developed prior to the Second World War than to numbers [Ref. 78]. The German offensive doctrine showed foresight and regardless of the source, the German *Wehrmarcht* used creative ideas in pioneering their new found doctrine.

1. Captain Andre Laffargue and the German Revolution in Warfare

In their search for a tactical solution to the riddle of the trenches, the Germans were aided by the experiences of a French officer, Captain Andre Laffargue, who had participated in an attack on Vimy Ridge in May 1915. He is an example of the effect of technology and creative use of command to control combat power. Unluckily for the allies, Laffargue's ideas were largely ignored in the French Army, and his pamphlet was not translated by the British. A copy was captured by the Germans and considered by them to correspond so closely to their own tactical thinking that it was immediately translated and issued as an official training manual. Laffargue had observed that two machine guns had held up battalions of advancing troops and that artillery could not get forward to neutralize the machine guns. Laffargue recommended in a pamphlet entitled *L'Etude sur l'attaque* that light cannon accompany the infantry in their attack to eliminate the problem of long-distance communications between the two arms, originating the infantry gun. The combination of movement and fire proposed by Laffargue and directed toward countering the decisive defense weapon, the well-posted machine gun, was

certainly the mark of 1917-1918 German infiltration tactics. Unlike British and French infantry, the infiltrating German infantry, while exploiting the effects of their own artillery fire, were expected to use the fire of their own rifles, grenades, mortars, and machine guns to advance. This represented a return to a doctrine of combining fire with movement that all armies had previously utilized. [Ref. 79]

Laffargue further advocated pushing machine guns and automatic rifles as far forward as possible and using mortars to suppress enemy trench defenses. No limit of advance was to be set for the first wave of sharpshooting skirmishers. These patrols were to continue boldly to penetrate empty spaces or, alternately, "creep through" enemy defenses to "throw him into disorder by surprise". It was the responsibility of subsequent waves to reduce the by-passed strongpoints of enemy resistance. Laffargue's suggested system differed from the normal practice of the time in attacking trenches, which was to spread out laterally, moving from fire bay to fire bay, bombing one's way along from traverse to traverse. This method took momentum out of the attack and was a costly and cumbersome procedure. [Ref. 80]

The German approach to breaching the impasse of the trenches of World War I, with the help of Laffargue and others, was much more imaginative than that of either the British or the French. Recognizing that artillery fire had compromised surprise and shattered the chain of command in the attack as well as in the defense, the Germans began turning the decentralized tactics of their elastic defense into new tactics for advancing. Methods used in the counterattack were accordingly applied to offensive operations. Instead of selecting limited objectives to be "conquered by artillery and occupied by infantry", the Germans expanded the infantry's role from the mere occupation and holding of ground to having the infantry conduct battle to break enemy resistance. In the view of Erich Friedrich Wilhelm Ludendorff, first Quartermaster General of the German Army, the German infantry had grown "flabby" in the defense, no longer "able to hold the enemy off and to fight from a distance". The infantryman had forgotten how to deliver accurate fire with his rifle; his main weapon had become the grenade.

[Ref. 81] This all required extensive retraining, only to be accomplished by the Germans.

The essence of German infiltration tactics was their high degree of decentralization of command. Instead of attacking "limited" hard objectives in waves, the advancing infantry flowed in small groups along lines of least resistance, seeking out "soft spots" through which to penetrate enemy defenses. In order to achieve maximum surprise, the attack was opened by an intense preliminary bombardment that lasted only hours instead of days. Designed and perfected by Lieutenant Colonel (LtCol) Georg Bruchmueller on the Eastern Front, the *Feuerwalze* had as its objective not the smashing of field fortifications but rather the paralysis of the enemy's communication and artillery. While providing close indirect fire support to attacking troops, it had the advantage of leaving intact the ground over which the infantryman had to pass. [Ref. 82]

2. European Military Thought Prior to WW II

a. Carl von Clausewitz

Although Carl von Clausewitz died prior to the Industrial Revolution, he occupied a leading position in German military thought during the forty-three year period prior to World War I, from 1871 to 1914. Under the influence of his writings, the Prussian Army defeated Denmark, Austria, and France through bold, offensive operations. Although an army on the defensive could protect and preserve, it could not conquer. After Clausewitz, one looks in vain through the literature on war for proponents of defensive operations. From Moltke the elder to Moltke the younger, Germany planned on quick victory through an offensive strategy, designed to destroy one enemy at a time. [Ref. 83]

b. Field Marshal Helmuth von Moltke

Field Marshal Helmuth von Moltke orchestrated the defeat of the Danes in 1864, the Austrians in 1866 and the French in 1870-1871, during which Prussian-German armies achieved rapid and final victories over their enemies. Moltke's name signifies far more than a list of 19th century battles. He predicted that future wars would

be long, drawn-out and total. He realized that increased lethality and range of both rifle and artillery fires necessitated changing basic military doctrine. He foresaw that strategic mobility could be multiplied by railroads. Finally, he used the telegraph to direct large armies in the field from great distances. He used this form of communication to enhance strategic flexibility by what he referred to as operational direction, the forerunner of what we now call operational art. [Ref. 84]

The Germans in the 19th Century delineated three levels of warfare: both the traditional strategic and tactical levels and the operational level [Ref. 85]. Although Moltke did not formulate an elaborate theoretical hierarchy of relationships among the strategic, operational and tactical levels of war, he recognized the fact that strategy has political content, while operations have a military basis [Ref. 86]. He introduced the term "operational direction" into the lexicon of modern warfare [Ref. 87].

Moltke's operations in the war with the Austrians and the Battle of Königgrätz were acclaimed as brilliant by a startled Europe. Concentration was achieved at the decisive point and at the right time to annihilate the mass of enemy forces. Although Moltke termed Königgrätz his most "elegant victory", its outcome had been close. In planning the campaign, Moltke's calculations were aided by an intimate knowledge of terrain, enemy order of battle, and the mind of the enemy commander. Among the conclusions he drew from the campaign was that the coordination among infantry, artillery and cavalry had not worked well together on the tactical level. He thought the cavalry had not satisfactorily performed its screening, security and reconnaissance activities. The artillery had not been concentrated, changed its position too frequently, lacked mass, and kept its trains to the rear, causing the forward guns to run out of ammunition during the culmination of the battle. While he thought the infantry had fought well, he believed that it should be more flexibly handled. At the operational level, Moltke thought his commanders had not coordinated the combat arms well. He afterwards commissioned a thorough study of the 1866 campaign, with astounding criticisms for a victorious campaign. [Ref. 88] The study did not mince words.

The cavalry must perform security and reconnaissance, the artillery must be concentrated, and the infantry must not only rely on superior weaponry but must standardize its order of battle and improve combined actions. [Ref. 89]

Moltke's development of operational direction reflected something different from tactics and strategy. He stressed that "demands on the operational commander are such that he must conserve his energy to see the overall picture clearly and not get too immersed in detail." He recommended that "the commander minimize orders, he should imagine the entire operation... The higher the commander, the shorter and simpler the orders must be..." "Within the view of the higher commander it is necessary only to tell the subordinate what is necessary to accomplish the purpose. [Ref. 90]"

c. General Oskar von Hutier

The pattern of trench warfare used in World War I was broken by the Germans. On September 3, 1917, forces under General Oskar von Hutier crossed the Dvina River, encircled and captured Riga and 9,000 Russians in a swift-moving campaign. More significant than the victory itself was the success of the new "Hutier tactics". Instead of prolonged artillery fire lasting days prior to an attack and with the talents of his brilliant artillery commander, LtCol Georg Bruchmueller, Hutier employed an intense bombardment of five hours duration without previous registration, thereby achieving surprise. He moved at night and by-passed centers of resistance, in effect "reinforcing success" instead of failure, by committing his reserves to support those units making most progress. [Ref. 91] His infantry abandoned the old linear tactics and advanced leapfrog fashion, similar to our current fire and move techniques. The stormtroops infiltrated in small groups, probed for weak spots and bypassed enemy strongpoints, ignoring exposed flanks and leaving them for the heavier, follow-on forces to reduce. Reserves were committed to reinforce success rather than being thrown in where the attack had stalled. These actions were radical tactics by World War I standards. [Ref. 92]

When the allies later encountered these tactics on a large scale on the Western Front, they somewhat erroneously labeled them "Hutier tactics". Actually, various elements of these tactics had been slowly developed and tested on a small scale during the previous three years on the Western Front by tacticians on both sides. Hutier was the first commander to bring them all together and use them successfully in a major operation. [Ref. 93] German military literature and documents reveal Hutier to be a capable general, a cousin of Ludendorff, but no tactical innovator [Ref. 94]. His strength lay in the fact that he was a man of great foresight who was able to recognize the value of the innovative ideas of others and apply them to the situation under his control. This ability to recognize creative thinking was also a strength he admired in LtCol Georg Bruchmueller. Bruchmueller, in conjunction with "Hutier tactics", in turn revolutionized the tactics of artillery for the Germans.

At the time, apparently only a few officers recognized the importance of the new tactics. General Pershing was one and Ludendorff the other. The "Hutier tactics" were used successfully by the Central Powers in their break-through against the Italians at Caporetto in October 1917, and again in the spring offensive on the Western Front in 1918. [Ref. 95]

d. General Hans von Seeckt

By virtue of his position alone, General Hans von Seeckt had the opportunity to leave his imprint on German Army organization and tactics. As chief-of-staff to Field Marshal von Mackensen, Seeckt had planned the great breakthrough at Gorlice-Tarnow in 1915. In 1919, Seeckt became postwar Chief of the German General Staff. The following year, he was appointed Chief of the *Heeresleitung*. In February 1919, he submitted to the German High Command a plan for a small standing army of about 200,000 men, including professionals, two-year volunteers, and some conscripts. A militia of conscripts would lend bulk and defensive strength to the standing army. Seeckt was thinking of a small, elite army as early as 1919. In 1921 Seeckt issued a memorandum stressing the necessity for the German Army to achieve technical superiority by uniting modern military science with modern military organization. He

wanted not to repair the old army, but to create a new one. [Ref. 96] Under Seeckt the German Army leadership did not complacently seek to create a small Imperial Army or to live in the past, but rather to begin a period of intense and critical examination of modern war. Seeckt's proposal of forming a 200,000-man army, with the limits of the Treaty of Versailles, based upon a two-year enlistment reflected his distrust for massive armies and a preference for a small professional force. [Ref. 97]

Some writers have suggested that Seeckt failed to recognize the true value of the tank, and that while he advocated a war of movement and mobility, he failed to explain how this was to be accomplished. It is true that his published writings emphasized horse cavalry and motorized units rather than tanks, but he did identity the principle which would insure success--the cooperation of all the vital arms. According to his plan, infantry, cavalry, artillery, and antitank weapons were to be integrated into one powerful striking force. German officers later attributed their tactical successes in the 1939-1940 campaign to effective implementation of this principle. [Ref. 98] Seeckt was correct in his belief that mobility and maneuver would be restored to the battlefield. He was wrong in thinking that a small, professional, highly mobile, elite army of 100,000 to 200,000 men would provide adequate security in a future war. Like Liddell Hart, he visualized this force being employed most efficiently in counterattack of an enemy invasion, but he also saw merit in surprise, lighting attack to forestall a planned invasion. [Ref. 99]

e. General Freytag-Loringhoven

General Freytag-Loringhoven was but one of the many generals who discovered after the stalemate on the Western Front in 1914 that the American Civil War had foreshadowed war on the Western Front [Ref. 100]. He was quoted as saying in 1918:

> In this sense, the American Civil War might have furnished us many a hint which was left disregarded.

In Europe only a few British officers attempted a study of the military history of the American Civil War but they concentrated on leadership and biography and

failed to draw any beneficial lessons from it. One of the important lessons was that the front extended from the Atlantic Ocean to the Mississippi River, a distance of about 900 miles, with cavalry detachments operating west of the Mississippi. A small professional army could not guard a frontier of this length. Several major battles could be raging on this front at one time; for example, the Battles of Gettysburg and Vicksburg were both being fought on July 3, 1863. This was different from Napoleonic warfare in which the French Emperor commanded his main force in person, usually arranged to fight one important battle at a time, and by means of mounted messengers controlled the movements of units which were deployed under his very eyes.

In 1917, while the powers were still locked in trench warfare, General Freytag-Loringhoven published a perceptive book in which he claimed that the trench warfare of World War I was an unusual condition, and that battles of movement would again dominate wars of the future. Freytag-Loringhoven was the first military writer to predict correctly, in print, the return of mobility to future warfare. [Ref. 101] He moved close to the doctrines of Clausewitz in advocating an army organized along flexible lines so that it could perform various missions. Experiences of World War I proved to his satisfaction that a rigid organization was unable to meet all contingencies. The addition of engineers, transportation, signal, and aviation units would provide the necessary flexibility. He thereby became a pioneer of the combined arms principle. [Ref. 102]

f. General Hermann Foertsch

A German officer who contributed nothing original but who made a remarkable analysis of the conflicting theories of the 1930s was Colonel (later General) Hermann Foertsch. In his *Kriegskunst* he attempted a synthesis of Clausewitz, Schlieffen, modern military theories, and technological developments. Foertsch predicted the failure of disarmament conferences which would lead to rearmament by most of the European nations. He criticized the theory that there were "main arms" and "troops of the second rank". Maximum efficiency, he insisted, could be achieved only through cooperation of all arms, including the air force. Foertsch challenged the suitability of small, elite,

mechanized armies for modern warfare and correctly foresaw a return to mass armies. While recognizing the value of tanks, he insisted that they were blind at night and in fog. For this reason they needed the assistance of motorized infantry. More than Fuller, Liddell Hart, and de Gaulle, he saw the value of airborne troops and predicted their use in large numbers. He condemned the Maginot Line concept, describing as tactically worthless any defensive position which could be outflanked. [Ref. 103]

In his concluding remarks he outlined the conduct of a future war. The strategic offensive would prove stronger than the strategic defensive, battles would consist of a continuous flow of masses of men and equipment, wars would be conducted on wide fronts with great depth, and armies would alternate between attack and defense. [Ref. 104] By predicting a return to mass armies he showed a keener appreciation of future war than Fuller, Liddell Hart, Seeckt, or de Gaulle. He recognition that the offensive would prove superior to the defensive and his emphasis on cooperation among the combined arms was more realistic than Fuller's all-tank doctrine. [Ref. 105]

g. General J. F. C. Fuller

In June 1917, General J. F. C. Fuller prepared a detailed tactical study on the capabilities of tanks, which proved to be a remarkably accurate forecast. Fuller predicted that tanks, properly employed, could penetrate existing German defenses and restore mobility to the battlefield. He prepared another study in May 1918 describing the *Blitzkrieg* of the future by advocating a massive surprise tank attack supported by aircraft. The objective was deep penetration into the enemy lines to paralyze the enemy's headquarters and communications. [Ref. 106] Of the early tank advocates, General Fuller outlined in greatest detail the use of tanks in a future war [Ref. 107].

Fuller was correct in his predication that the internal combustion engine would restore mobility to the battlefield and that armor would penetrate fixed defensive positions. He pointed out the inherent weaknesses in the Maginot Line and similar static defensive positions and recommended substitution of a defense of much greater depth,

combined with a powerful mechanized reserve. His insistence that a mechanized force should include both tank and antitank units was confirmed by the German experience in France and Africa. [Ref. 108] He had a fairly clear understanding of the obstacles mechanized units would have to overcome before they achieved their maximum potential, and he proposed more solutions to these problems than any military writer. He suggested preparation of "mechanized warfare maps" to inform commanders of suitable and unsuitable terrain for armored operations, and he called for construction of special ships to transport tanks and deposit them on hostile beaches. Both of these suggestions were adopted during World War II. [Ref. 109]

He correctly foresaw that effective tactics required close cooperation between offensive and defensive action, and that in both forms of action, mechanization would play a dominant role. His visualization of the increased importance of engineers in both attack and defense was justified, as was his claim that horse cavalry could play no significant part in mobile warfare. Fuller concentrated on the conduct of war on land, but he saw that there must be close cooperation between air and ground forces, and that one of the first missions of an air force must be the seizure of local air superiority. [Ref. 110]

Not surprisingly, such a prolific writer erred in some of his theories. Fuller was above all a proponent of the "all-tank" school. He felt the other arms (infantry, artillery, engineers, even the tactical air force) would be utilized best in assisting the advance of mechanized units. He wanted the best men assigned to armored units. Solders of the "second degree" would be assigned to the infantry where they would follow armored units and occupy territory already overrun tanks, thereby freeing the armor to continue on its rapid way. [Ref. 111] If the Germans had adopted these views they would have been stopped by the water obstacles in the Lowlands and France. It was German infantry which first crossed the Meuse River and secured a bridgehead before the armor crossed. Where Fuller looked upon infantry as a hindrance to armor, the Germans recognized that infantry and armor in close cooperation increased the flexibility and capability of armored divisions. Fuller had not foreseen that

mechanized infantry could move as rapidly as armored units, and when airborne, could travel farther and faster, overcoming obstacles which slowed tanks. [Ref. 112]

Fuller's theories and ideas suffered as a consequence of his uncompromising methods and his unpopular political views. In Germany they were better received. Guderian readily admitted the influence of Fuller's ideas on German armored doctrine. Ropp viewed him as "the real father of the *Blitzkrieg*," and Liddell Hart described him as superior to Napoleon and Clausewitz in imaginative powers and mental range. [Ref. 113]

h. B. H. Liddell Hart

Basil H. Liddell Hart is credited with originating a new strategic and tactical concept of warfare. In fact, the principles on which the concept was based, surprise, the by-passing of resistance, and the reinforcing of success instead of failure had already been applied so well by the General Hutier in 1917. Whereas Hutier exploited the gap with the advance of cavalry and infantry, Liddell Hart improved the technique by employing tanks and aircraft. His ideas merely modernized the Hutier tactics.

He advised professional soldiers to study many campaigns since, in the physical sphere, conditions varied. The real constant was human nature. In strategy, the longest way around was usually the shortest route to the objective because it disrupted the enemy's equilibrium. He felt perfect strategy could compel the surrender of the enemy's armed forces without fighting battles. This indirect approach could be strategic, tactical, geographical or psychological: the essential element was the disruption of the enemy's composure by confronting him with the unexpected.

Liddell Hart concluded that two strategic and tactical maneuvers frequently produced victory. An elastic or mobile defense which lured the enemy into a trap where he was then destroyed by a counter attack, and offensive tactics which maneuvered the enemy into a highly dangerous position. These would compel the enemy to surrender or accept battle under conditions disadvantageous to him. [Ref. 114]

General Sir Frederick Pile credited Liddell Hart with influencing the British Army to adopt night attacks, concealment, attack by indirect methods, exploitation far behind enemy lines, and to use scientists to assist the army in developing more efficient ways of winning battles. It is true that Liddell Hart advocated these principles, but it would be incorrect to credit him with originality: the Old Testament relates a night attack by Gideon, and Washington crossed the Delaware and marched on Trenton at night. The theory of indirect approach on the other hand is as old as the story of the Trojan Horse. In addition to the ancient Greeks, Clausewitz had recognized the importance of this principle, and devoted one section of his work to "The Surprise," and another to "Stratagem". Sherman's march to the sea, and World War I's Gallipoli campaign were more recent examples of the unexpected in warfare. As with his "expanding torrent", Liddell Hart's "indirect approach" was mostly a new name for an old, recognized principle. [Ref. 115]

Liddell Hart deserves credit for recognizing that infantry, including paratroops, would play a significant part in a future war despite the growing importance of tanks and aircraft. He wanted infantry units provided with trucks or armored cars for increased mobility. Thus, he was more realistic than Fuller, but still behind Guderian who developed the combined arms principle to its full potential by adding substantial engineer and signal support to the armored nucleus. [Ref. 116]

Like Fuller, Liddell Hart recommended the principle of small, elite, mechanized armies as the ideal solution to defense problems. This was not only economically desirable, but militarily preferable as well. Mass armies, he predicted, would overtax existing road and transportation facilities and bog down. [Ref. 117] Fuller doubted that the outbreak of war would immediately witness great battles whereas Liddell Hart came closer to a better seer by forecasting a lightning-like attack by an aggressor. The lessons of history as he saw them made it clear that a counterattack after the enemy had overtrained and exhausted himself was the best strategy because it combined the immediate advantages of the defense and the ultimate advantages of the attack, and usually led to victory. He supported his theory with historical examples

from several battles. Once again, however, he was largely echoing Clausewitz who wrote that the proper way to fight a defensive battle was by counter attacking "when the assailant's plan is fully developed and most of his troops have been spent". [Ref. 118]

i. General Heinz Guderian

The driving force behind German technological and tactical armored development, including their command and control, was General Heinz Guderian. He spent almost his entire career from 1922 to 1939 with motorized and armored units. Guderian readily admitted his debt to the English armor pioneers, Fuller, Martel, and Liddell Hart, yet sometime during the 1930s Guderian's tactical and strategic views on armored warfare had progressed beyond those of the English and the French theorists. [Ref. 119] Guderian developed the tactics which the German Army would employ so effectively in Poland and France during 1939 and 1940. He would have all units advance at the maximum speed. Instead of slowing down the speed of tanks to the pace of infantry as the French High Command advocated, he would speed up the advance of infantry by mechanized means to keep pace with the armor. He would not assign tanks to infantry divisions; rather, he would organize armored divisions to include motorized infantry and all the other supporting arms. Tanks would play the primary role in these formations, but the cooperation of all arms was the essential feature. In these armored divisions the infantry and artillery would function as subordinate, but not "second line" troops as envisaged by General Fuller. Guderian's armored division would be an elite unit of the combined arms relying primarily on the speed and shock action of tanks for maximum initial effect. [Ref. 120]

In 1934 the British Army held maneuvers which proved to be a milestone in the development of armored theory. General P. C. S. Hobart, commanding the First British Tank Brigade, demonstrated that mobile armored units could make deep strategic penetrations into enemy territory and that offensive rather than defensive operations might indeed dominate the battlefield of the future. This lesson was not grasped by the British

or French High Commands at this time, but it was noted by Guderian in Germany. [Ref. 121]

Guderian is considered the creator of German armored doctrine. While admitting that Fuller and Liddell Hart were the pioneers, Guderian demonstrated sound judgement in retaining only their workable ideas while rejecting many of their unrealistic concepts. Recognizing that foot soldiers were better suited than armor for certain combat operations, he kept infantry near the head of his advancing columns. Instead of slowing down tanks to protect infantry, he speeded up the infantry to keep pace with the armor. Motorized infantry was never far behind the armored spearhead and a friendly rivalry ensued between tank units and motorized infantry, the latter making it a goal to see how quickly they could catch up to the tanks. In some cases, infantry in trucks covered longer distances than armor. [Ref. 122]

In the 1930s Guderian took the initiative in organizing maneuvers in which trucks simulated tanks. He vigorously opposed assignment of tanks to infantry divisions, maintaining that this would seriously dilute the capabilities of armor. Germany must form armored divisions initially, then armored corps and tank armies. He likewise rejected Fuller's doctrine of all-tank units working on their own. [Ref. 123]

During World War I, every corps headquarters had established itself in permanent buildings, elaborately equipped with communications facilities and various civilized comforts. Guderian was the first corps commander in history to conduct operations from an armored vehicle on the move devoid of the unnecessary luxuries [Ref. 124] at the time normally associated with higher headquarters.

Although not a military theorist, Guderian, like Foertsch, showed a realistic appreciation of the possibilities of mobile warfare [Ref. 125]. Where Fuller saw the next war beginning with cautious preliminary skirmishes, Guderian believed in great battles from the very beginning. Fuller later admitted his error, and credited Guderian with being the first practical exponent of the *Blitzkrieg* and the theory of strategic paralysis. [Ref. 126]

j. General Erich von Manstein

General Erich von Manstein possessed the reputation of having perhaps the finest operational mind in the German Army, a reputation enhanced by his role in the operational planning against Poland and France. Aloof, egotistical, sarcastic, and on occasion arrogant, Manstein had few friends but many admirers. [Ref. 127]

In one important respect Guderian was wrong. He believed that an offensive should have one powerful spearhead, that tanks should strike hard (*klotzen*) at one position at a time. Manstein, supported by Hitler, preferred to attack with multiple armored spearheads instead, and persuaded Guderian to agree. [Ref. 128] Manstein worked out the idea of the German assault into France under great pressure. The German victory over France was the result of a very-well thought-out plan and superior military execution. The plan developed by Manstein was one of the most brilliant operational ideas advanced in the history of German military thought. Although not allowed to participate directly in the execution of his plan due to other responsibilities, Manstein was its sole author and all credit properly goes to him for his outstanding work. [Ref. 129]

In his book *Panzer Leader*, Guderian described Manstein as "our finest operational brain." Manstein had a distinguished military career and reached the coveted rank of Field Marshal after his seizure of Sevastopol in 1942. Manstein was not a writer. His fame as a military theorist and strategist rests on his successful operational plan for the invasion of the West in 1940. In addition to his conviction that a drive through the Ardennes was possible, Manstein went beyond Fuller, Liddell Hart, and even Guderian in developing an offensive of multiple armored spearheads. [Ref. 130]

B. GERMAN DOCTRINE PRIOR TO WORLD WAR II

Ludendorff issued the army new regulations for offensive action in early January 1918 that affected German doctrine/ command and control. The most important idea was that the infantry must continue to advance into the enemy's rear, leaving the task of reducing bypassed enemy strongpoints to the second or third attack waves. German

infantry regiments would hereafter possess their own cannon company, whose task it was to accompany the infantry and destroy nests of enemy resistance with direct fire (this was the origin of the infantry gun, the predecessor to German assault artillery and the Antitank gun). Engineers, usually equipped with flame throwers and explosives, would also support the attacking infantry along with additional signal troops, liaison officers, runners, and orderlies. Through these measures Ludendorff hoped not only to win a decisive victory over the French and English, but abandon trench warfare and return to a war of movement. [Ref. 131]

Rejecting World War I's positional warfare, Seeckt and his advisors created a system capable of critical self-examination and analysis of wartime experiences, and of foreign military developments. Undoubtedly, one reason for this scrutiny was the defeat of the German Army in World War I, which spurred on the officer corps to find new solutions [Ref. 132] and new doctrine.

An entire *Panzer* training division participated in the July 1935 maneuvers. Based on the impressive performance of the tanks, the German army announced plans for organization of three active armored divisions in October 1935. Germany was well on the way to superiority in mobile, armored warfare. Equally as important as quantity and quality of equipment was the adoption of sound strategic and tactical doctrine. In 1933 the German Army had began work on its manual for *Truppenführung* (troop leading). Distributed in 1936, this guide stated the official armored doctrine: tanks were to be the basic weapon of the *Wehrmarcht*. The tanks would not be slowed down to the speed of infantry; on the contrary, infantry movement must be accelerated to keep up with the momentum of the armor. The armor would provide the sledge hammer blow at decisive objectives, while the motorized infantry would mop up remaining enemy resistance. [Ref. 133]

During the Spanish Civil War the German Army sent a reinforced regiment of 180 tanks to Spain. This unit acquired useful information in small-unit tactics but did not engage in any massive assaults. German observers concluded that the lessons of the war confirmed the soundness of their doctrine of assigning a major role to armored units

rather than immobilizing the tanks by restricting them to the pace of infantry. The few encounters with the heavier Russian tanks encouraged the Germans to speed the production of their own heavy tanks. [Ref. 134]

During much of the period between the World Wars the German Army devoted most of its time and effort to defensive plans and maneuvers against possible invasions. Only after the army began its expansion in 1933, after Hitler came to power, did political and military leaders obtain a greater degree of flexibility and initiative. On the offensive or defensive, the German Army grasped the importance of "combined arms" operations. The British and French were concerned with the relative ranking of their arms: was armor more valuable than cavalry, and was cavalry more important than infantry? The German Army combined its armored units with motorized infantry, artillery, and engineers, and cooperated with the air force in close support of the ground forces. German doctrine visualized a key role for tank units in both offensive and defensive doctrine. [Ref. 135]

C. TECHNOLOGY AND THE DEVELOPMENT OF GERMAN DOCTRINE/COMMAND AND CONTROL

The levels of war (strategic, operational and tactical) have been influenced by technology caused by the Industrial Revolution. For most of recorded history the speed at which an army could travel on land or be controlled, for that matter, was limited by the speed at which a horse could run. Napoleon's cavalry could move no faster than the cavalry of Alexander the Great; Napoleon's infantry could march no farther than the legionnaires of Julius Caesar. The bow and arrow was an important weapon in Homer's *Iliad*, and at the siege of Orleans in 1428-1429. [Ref. 136]

Throughout the centuries the tools of war changed but little. It was understandable that generals planned and conducted battles in the same manner as did their predecessors. Yet, changes did occur, and occasional developments such as the invention of the stirrup, body-armor, the long-bow, gunpowder, steam, and the internal combustion engine created opportunities for talented generals to surprise their enemies. Technological change and

its effect on command and control came rapidly in the nineteenth century. Until then, it was usually safe for a commander to begin a new war in the same manner as the last one ended because he could rely on his enemies to adhere to the same doctrine. Since the beginning of the nineteenth century, however, a general could no longer trust his opponent to be unprogressive. [Ref. 137]

The German Army of World War II, to say the least, was progressive. In looking at German command structure and its effect on the control over supporting arms, one cannot ignore the historical effects of technology in the application of control. An excellent example, during World War II, of technology's effects on command and its ability to control combat power could be seen when German artillery engaged Soviet tanks. The Russians placed radios only in a few command tanks, to the detriment of the tank force as a whole. This, coupled with German obscuration fires and the relative blindness of Russian tank crews, allowed the Germans a competitive edge in favor of their artillery in its battle against Russian tanks. Technology had a profound impact on the development of the German command and control structure.

1. The Industrial Revolution and Theoretical Development of Modern Warfare

The traditional view is that modern war began to emerge around the time of Gustavus II Adolphus (1594-1632) who is certainly considered the father of modern artillery. Geoffrey Parker, in *The Military Revolution*, expanded the duration of the origins of modern war to include the origin of industrialization in England (around 1750). This broad period (Parker used 1500-1800) is not in consonance with the term "revolution" as meaning "a comparatively sudden and violent change". Edward Hagerman offered a new and persuasive counterargument in *The American Civil War and the Origins of Modern Warfare* that the revolution in modern warfare actually occurs in the relatively short span of the American Civil War. [Ref. 138]

If the Industrial Revolution generated a concomitant revolution in military reality, who recognized it? Certainly not Clausewitz, who died in 1831 just as industrialization began to emerge on the Continent. Nor did Jomini, who died in 1869.

One who did recognize the implications of the industrial revolution on warfare was a now-forgotten German officer writing after the American Civil War, who saw reality as it really was. His name was Sigismund von Schlichting (1828-1909) the great interpreter of Helmuth von Moltke (the elder). [Ref. 139]

Studying Moltke's campaigns, Schlichting came to recognize that a qualitative change had occurred in the conduct of war. Schlichting quoted Clausewitz extensively to show how the Clausewitzian model no longer adequately reflected reality. Clausewitz defined strategy as the art of using battles for the purpose of war, Schlichting emphasized the importance of using operational maneuver without battle to achieve the purposes of war. [Ref. 140]

Jan S. Bloch (1836-1901), a banker from Warsaw, published a multivolume, multilanguage work (this was translated into English as *The Future of War*) in which he mapped out the theory of future war. He is considered the father of modern military science. His thesis was that future war would become impossible to wage successfully because nations lacked the economic depth to conduct protracted military operations. His perspective encompassed the conduct of war as a totality. He addressed issues of operational art and campaign planning. Like so many theorists, however, he failed to redirect the core of professional understanding dominant at the time. [Ref. 141]

Following the turn of the century, the evolution of operational theory took a decisive shift towards the East. The Russian Imperial Army had acquired a rich base of experience that nurtured the growth and flowering of operational theory. Schlichting's work was translated into Russian in 1910 and used at the General Staff Academy. More importantly, the recent Russo-Japanese War provided a relevant historical context to give Schlichting's ideas greater and renewed impetus. The Russian experience in World War I further confirmed many of the ideas espoused by Bloch and Schlichting. In 1917, the Russian Revolution finally destroyed the old Napoleonic world view and demonstrated one of the most powerful dynamics affecting operational art--the impact of political revolution on military thought. [Ref. 142]

The fires of the Russian Revolution destroyed the undergrowth of old, outmoded ideas of warfare. In the absence of these dogmatic professional weeds, new beliefs took root and flourished. The first-ever treatise on operational art, published in a form a modern reader could readily understand, was written in 1929 by Triandafillow (1894-1931) and entitled *The Nature of Operations of Modern Armies*. In this work, the author set forth the ideas of the operation and successive operations as the primary form of modern warfare. He sought to link several successive operations into one single continuous deep operation. The subsequent work of Tukhachevsky (1893-1937) further developed the idea of the deep operation. [Ref. 143]

The theory of operational art flourished in the Soviet Union for two reasons. First, the political revolution had destroyed the dominance of the old Imperial military understanding. Without this professional foundation to sustain and justify causally existing beliefs on waging war, the previous refracted view of reality was seen with a clearer, theoretical eye. Several years of war, rich in operational experience, were there to study and analyze. [Ref. 144]

Western theories of operational art were shaped ultimately by the solutions developed toward ending the tactical stalemate on the Western Front in World War I. The Germans found a solution with the institution of small-unit storm tactics. The Allies countered with a technological answer, the tank. By 1939, the Germans had developed a theory of operational art founded upon two elements: *Blitzkrieg* and operational exploitation. *Blitzkrieg* was a theory of combined arms tactics aimed at achieving rupture through the depths of the enemy's tactical deployment. Following tactical rupture, rapidly moving armored forces would exploit the tactical penetrations by driving deep into the operational depths of the enemy and shattering the coherence of his defense by means of encirclement. [Ref. 145]

The theory of operational art was initiated in Great Britain by J. F. C. Fuller (1878-1966) and B. H. Liddell Hart (1895-1970). The most relevant of Fuller's works on theory include *The Reformation of War, The Foundations of the Science of War, On Future Warfare, Lectures on FSR III, Machine Warfare* and *Armored Warfare*. Liddell

Hart's theory of the indirect approach can be found in *Strategy*. [Ref. 146] These works had significant effect on the thinking of general officers and military writers between the wars and on German command and control used during World War II.

2. Moltke and Technology

Helmuth von Moltke was one of the first in the modern era to recognize the importance of technology in war. This recognition had a profound impact on the conceptual development of his "operational direction" and command and control of his forces.

"March separately and concentrate on the battlefield" was Moltke's dictum. Moltke viewed concentration of force as being planned to accomplish a set objective. The time needed to mobilize and deploy armies decreased through the use of technology such as railways. Massing had to be purposeful and result in battle. Moreover, it had to be done in such a way that preponderance of force arrived at the right time and in the right place to produce victory in battle. Bringing the force from afar, in a timely way, with enough mass to defeat the opponent in battle was the essence of operational art [Ref. 147] and could be exploited through the technology of the time.

Recognizing the defense as the stronger form of war, Moltke held that the technological development of firepower made tactical attack costly. It was better to let the enemy forces attack first, and after shattering them, counterattack. Moltke believed in the value of flanking maneuver. He recognized that operational direction was to attack the enemy by maneuver with an advantage of time through space to create these open flanks. Moltke was able to effect control by using railways to concentrate forces faster than the enemy. [Ref. 148]

3. The Influence of Technology on German Doctrine/Command and Control

It would be too much to say that by the end of World War I, trench warfare in its classic form had been left behind, although the foundations for overcoming trench warfare had been laid. On the German side, the introduction of the flamethrower, the submachine gun, and artillery pieces light enough to be hauled forward and used in direct support of assault parties formed part of the highly innovative infiltration tactics which

were developed in successive stages from the spring of 1916. On the Allied side, a technological solution was found in the form of a tank. This was simply an armored box on tracks that could advance up to and across enemy defenses while raking them with fire from cannon or machine guns. Tanks were capable of providing cover for the infantrymen following behind. These tactical and technological innovations permitted the defensive arrays on both sides of the front to be breached time after time. While the logistical problems of modern warfare could not be overcome by the foot infantry alone, tanks, with their insatiable demand for fuel, spare parts, and maintenance, created many logistic problems of their own [Ref. 149] and consequently had a great effect on command and control and supplying modern war.

Tanks, after the First World War, did not necessarily figure high on the priority list of the armies of France, England, the USSR, the United States, and Germany (the latter proceeding in secret and on foreign soil). All experimented with a variety of tracked armored vehicles that often assumed bizarre shapes. Fire power, armor, speed, range, and reliability were all gradually improved. By the end of the thirties most tanks carried one main gun in a revolving turret on top of the hull. This configuration made them suitable primarily for fighting vehicles and other tanks in the open and less so for dealing with infantry, especially entrenched infantry in broken terrain. From the moment the first large-scale experiments in armored warfare were made on England's Salisbury Plain in 1927, it was clear that tanks would have to be accompanied by infantry and field artillery. If the tanks were not to be slowed down by these components, the infantry and artillery would have to be motorized, or preferably mechanized, with infantry riding armored personnel carriers and the artillery being self-propelled (SP's). Add antitank artillery to enable one's own infantry to resist enemy tanks, plus engineering, maintenance, logistic services, and a signals detachment to permit control of the lot, and the armored division was born. [Ref. 150]

At the beginning of World War II, only the Germans and the French had properly organized armored divisions. During the 1939 campaign in Poland, the Germans gained valuable experience in handling armored divisions. Later, using between ten and

twenty of these units, as well as a similar number of motorized formations, they were able to win a series of spectacular triumphs that have since become almost legendary. A typical *Blitzkrieg* campaign opened with a devastating blow against the enemy's airfields, aimed at gaining superiority in the air. Simultaneously, troops would be brought in by transport aircraft, or glider, or dropped by parachute in order to seize objectives in the enemy's rear and hold them until the ground forces arrived. On land, heavy attacks by massed artillery and dive bombers supported armor and infantry which tore open holes in the enemy front at selected points. Once a gap had opened up, the armored divisions would pour through. The armor was preceded by the air force acting as flying artillery and was also used in the interdiction role, and followed by motorized and infantry units to consolidate the territorial gains made. The armored divisions would take the line of least resistance much as water flows down a slope. Victory in a campaign was usually due less to heavy casualties on the defeated side than to confusion, disorganization, and panic. To paraphrase Napoleon's dictum: lighting war was made with the tanks' tracks not their guns. [Ref. 151]

Though there was much variety between theaters and campaigns, the victories that grew out of these tactics were not due primarily to technological superiority on one side. In 1940-41, not only did all important countries have tanks but in many cases, e.g., France, their tanks were more numerous, and of better quality, than those in the hands of the German *Wehrmarcht.* Only in one very important respect was the German Army clearly superior. At a time when most Western tanks carried only receiving sets, and when Russian tanks frequently had no wireless sets at all, the Germans under Generals Guderian and Fellgiebel--the latter an officer in charge of the signals troops, whose contribution to the *Blitzkrieg* has been largely overlooked by historians--insisted that every *Panzer* should come equipped with two-way radio. Their armored divisions thus acquired very great tactical and operational flexibility such as rarely has been equaled before or since. This flexibility in command and control, possibly even more than the tanks themselves, constituted the true core of the new style in warfare. [Ref. 152] The German triumphs such as the 23-day drive that carried them from the River Bug in

Poland all the way beyond Smolensk [Ref. 153] were nothing short of spectacular.

III. ANALYSIS OF THE GERMAN COMMAND AND CONTROL ARCHITECTURE

A. THE GERMAN 7TH *PANZER* DIVISION - IN FOCUS

The performance of the 7th *Panzer* Division (7.Pz.D.) during the German push through France and the early drive into Russia was indicative of the German Army, its doctrine, and its command and control during World War II. The Division's performance was laudable under two different commanders: Rommel during the French Campaign in May and June 1940 and Funck during the Russian Campaign from June to October 1941. [Ref. 154]

1. The Function of the 7th *Panzer* Division

The purpose of the 7.Pz.D. was to destroy the opposing forces in combat through what we refer to today as maneuver warfare and associated points of major effort (a concept of centrality) or *Schwerpunkten* (literally, German for heavy points) [Ref. 155]. The German system of command and control responded dynamically to enemy actions. This capability of dynamic response can be attributed to the decentralization of German command and its matrix organization of combat power. This combat power characteristically became organized into what the Germans referred to as "Battle Groups". The battle groups provided commanders with task-organized combat power for the specific task at hand to close with and to destroy the enemy or use maneuver to effectively neutralize the enemy's combat power.

2. The Division's Organization and Command Functions

a. Command Functions

(1) The German Commander. Henri de Jomini defines a decisive point as one that enables its holder to make a correct application of the principles of war [Ref. 156]. The German generals had a firm grasp of this concept and placed themselves well forward operationally, to exploit it. In fact, they placed themselves so

far forward the German general officer casualties in World War II were higher proportionally than those of any other army and an argument could be made that such losses adversely affected the respective commands. Due to these losses, divisions often were commanded by colonels, regiments by majors, and battalions by captains. [Ref. 157]

The German Army's views on command and control during war the Second World War were outlined in 1936 in *Truppenführung* (Command of Troops). The following guidelines reflected the importance of frontline, senior-level leadership [Ref. 158]:

- Personal influence by the commanding officer on his troops is of the greatest importance. He must be located near the fighting troops.
- A divisional commander's place is with his troops.... during encounters with the enemy seeing for oneself is best.
- Commanders are to live with the troops and share with them danger, deprivation, happiness, and suffering. Only thus can they gain a real insight into their troops' combat power and requirements.

German officers of all grades took this doctrine to heart, achieved tactical successes and paid a high price in blood. The German attitude toward combat had been shaped strongly during the First World War. The German Officer experience was characterized by a high degree of frontline service and effectiveness in combat. Repeated demonstrations of bravery in action were expected of junior officers during the First World War. These junior officer became the generals of World War II and had developed their concept of battlefield leadership and danger the hard way; they had earned it. [Ref. 159]

(2) The German General Staff. The General Staff of the German Army was an elite organization made up of brilliant professionals. Its uniqueness can be attributed to the Treaty of Versailles. A German General Staff was not allowed so the Treaty forced the Germans into secrecy. Nobles served in large numbers in the General Staff and staff work was one of the few jobs thought worthy of their station in Germany between the Wars. The General Staff education at the *Kriegsakademie* (War Academy) lasted two years. The standards were highly selective and extremely demanding. The

goal of the *Kriegsakademie* was to train General Staff officers as advisors and assistants to commanders of larger formations and to provide officers for the Army staff. The Germans manned and organized the staffs of their divisions in a manner that stressed decisiveness and quickness in combat. [Ref. 160] General staff officers alternated in command assignments in order to make them better staff officers. The German system of staff officers was almost completely the reverse of the American system in which officers become staff officers to become better commanders. In the American system, no particular prestige was associated with being a staff officer.

b. Organizational Units

(1) The 7th Panzer Division Organization - See Table 1.

7TH *PANZER* DIVISION and ORGANIC UNITS [Ref. 161]

7.*Panzer*-Division
(7th Armored Division)
7.Pz.D

MAIN MANEUVER ELEMENTS	MAIN COMBAT SUPPORT ELEMENTS
Panzer-Regiment 25 (25th Armored Regiment) Pz.R.25	*Artillerie*-Regiment 78 (78th Artillery Regiment) A.R.78
Schützen Regiment 6 (6th Motorized Regiment) S.R.6	*Pionier-Bataillon* 58 (58th Pioneer Battalion) Pi.58
Schützen Regiment 7 (7th Motorized Regiment) S.R.7	*Panzerjäger-Abteilung* 42 (42d Antitank Detachment) Pz.Vg.42
Panzer Auflärungsabteilung 37 (37th Armored Reconnaissance Battalion) Pz.A.A.37	*Leichte Flak Abteilung* 59 (59th Light Antiaircraft Det) Fla.59
Kradschützen-Bataillon 7 (7th Motorcycle Battalion) K.7	

Table 1

(2) German Battle Groups - The German Army was based on a matrix-type organization. The *Wehrmarcht* used their matrix organization to assemble combat battle groups (*Kampfgruppen*) that by definition were task-organized for specific missions. The *Kampfgruppen* were very flexible organizations that were readily put together. Since the battle groups were task organized (i.e., self-sufficient for a limited period of time), their purpose was to support the

German concept of decentralization of command and control and ultimately to contribute to overall success and viability of the German Army on the battlefield. The 7th *Panzer* Division characteristically put together various *Kampfgruppen*, sometimes several each day. The process of advancing from one objective to another can almost be seen as the formation of one battle group after another, forming and reforming to accomplish the constantly changing tasks. [Ref. 162]

During a major offensive, the division commander often moved the division along two axis of advance to keep the conditions of battle fluid. This was accomplished by forming two different battle groups, one on each axis of advance. In France, Rommel often would send the 7th Motorcycle Battalion in advance of the rest of the division, and on several occasions personally accompanied it with a couple of armored reconnaissance vehicles. Under such conditions, Rommel often orchestrated a second axis of advance, somewhat to the rear, led by the 37th Armored Reconnaissance Battalion in a stronger *Kampfgruppe*, for which it was the advanced detachment. In the Soviet Union, Funck used the two battalions similarly, and in the dramatic rush to the Moscow Autobahn east of Smolensk near Jarcewo on 14 and 15 July 1941, he had the two elements moving along two different axis of advance. The motorcycle battalion, with its two motorcycle companies and weapons companies of 80mm mortars and *Pak* guns, struck an effective balance between low "starting inertia" and combat power which was ideal for forming and reforming battle groups. The armored reconnaissance battalion, with its two armored reconnaissance vehicle companies, motorcycle company and mobile supporting infantry cannon, struck the same balance. [Ref. 163]

The following table shows an example of a *Kampfgruppen*:

7.Pz.D. Advanced Detachment (0300 4 July 1941)

COMMANDER: Commanding Officer of Division Artillery Regiment				
UNITS:	1 Battalion	S.R.6	1 Company	Pz.R.25
	1 Platoon	2./Pi.58	2 Batteries	I./A.R.78
	1 Platoon	2./Pz.Jg.42	1 Battery	Nbl.Rgt.51
	1 Platoon	88mm *Flak*		

Table 2

This battle group was put together by Funck in Russia. Funck showed originality and decisiveness in putting together this advanced detachment, because he assigned the commander of A.R.78, his artillery chief and the fire support coordinator, to lead the detachment. [Ref. 164]

B. THE ORGANIZATION OF THE 7TH *PANZER* DIVISION.

1. The Viable Organization of the 7th *Panzer* Division

The organization of the German Army gave credibility to the German method of command and control. The German system had a dynamic response range that gave it stability within its ever-changing environment. Many factors contributed to give German combat power a vital ability to respond to any crisis that could occur and ensure that the system was rarely exceeded:

a. The German General Staff

English Military Historian Basil Liddell Hart said of the German General Staff: "The German generals of this war were the best finished products of their profession anywhere. They could have been better if their outlook had been wider and their understanding deeper. But if they had become philosophers, they would have ceased to be soldiers." [Ref. 165] After the war the idea that the General Staff had plotted Hitler's aggressive course was addressed in the proceedings at Nuremburg. The General Staff was acquitted and it was concluded that its officers were essentially technicians, brilliant in the pursuit of their profession, but politically naive. [Ref. 166]

So what, then, made the officers of the General Staff "the best finished products of their profession anywhere"? To understand one might look through the eyes of Major General Friedrich Wilhelm von Mellenthin [Ref. 167], a brilliant General Staff officer of World War II. The General Staff followed two decrees meticulously: "General Staff officers have no names" and "Great achievements, small display; more reality than appearance." The decree that General Staff officers have no names helped to preserve general staff anonymity after its existence was outlawed by the Treaty of Versailles. By abolishing the General Staff and closing the war academy, the Allies simply drove the functions underground, creating a mystique

that is difficult to describe. Its military spark and creativity blossomed in secret. That mystique fed on secrecy. The dysfunctional edicts of Versailles made the General Staff an elite, almost masonic, order. [Ref. 168] Nobles, because of their social standing, dominated the General Staff. Their aristocratic manners and self confidence caused the unschooled and insecure Hitler to fear and hate them. Because officers' commissions had become extremely rare, the army attracted an even higher proportion of nobles than it had under the Kaiser. In the politically unstable *Weimar* Republic (1919-1933) the nobility saw military service as being "above politics". It was considered one of the few professions worthy of their station. [Ref. 169]

To get into the General Staff, one had to be nominated as a candidate for General Staff training based on education and tactical flair. To enter the program, an arduous week-long qualifying examination had to be taken. It was not uncommon for more than 1000 officers to assemble for the exam, and only about 150 or so to be admitted to the *Kriegsakademie*. In 1933, the General Staff course was shortened from three years to two to meet the increased demand for staff officers caused by Hitler's rapid expansion of the army. During the first year, beginning on 1 October 1935, the course consisted of nine months of lectures and staff exercises. The only break in the desk work was a weekly field exercise with maps, but without troops or equipment. At the end of June, the candidates were sent on a three-month cross-training assignment with a branch of some combat arms other than their own. Then came the autumn maneuvers. The pattern of the second year was much like the first, only more grueling, as marginal candidates was weeded out. The cream that remained were sent on a probationary 18-month assignment to selected General Staff slots and, only upon successful completion of the tour, were officers awarded the title of *Generalstabsoffizer*. [Ref. 170]

b. The German Commander

The personalities of World War II German generals were strongly influenced by the lessons of World War I and the inter-war years. Their personalities, as with any commander in any armed service, were absorbed by the men of the organization they commanded and played a significant role in the organization's combat effectiveness. To understand the personality of the German commander, three German generals - Rommel, Balck, and Guderian - are highlighted

as recalled by Major General Friedrich Wilhelm von Mellenthin. [Ref. 171] Mellenthin, a General Staff officer, served with two of the three Field Marshals and knew the third.

(1) General Erwin Rommel. He was a tough taskmaster and spared no one, least of all himself. He spent most of his time at the front, where he could control the battle and seize the initiative. Rommel was not one simply to act as a blocking force, or 'stand and defend'. He saw no future in timid tactics or static defense. He was quick and decisive, taking to the offense at any chance, to exploit all opportunities. He was always at the front, at the decisive point of battle, often out of touch with his staff for days at a time. On one occasion after a long absence, recalls Mellenthin, Rommel burst into the command post and gruffly demanded "What is the situation?" After a crisp 5-minute summary, he would need no more than 30 seconds to analyze facts and act on them. He would sometimes issue standing orders for an entire week. Very seldom did these need to be modified.

Rommel was wary of the German Staff contingent sent from Berlin in June 1941 (to Africa). He snubbed Mellenthin and the staff for a long time, saying "I don't need a staff." Rommel knew their value, but he was all too aware of the dual reporting system by which General Staff officers reported to him publicly, and about him privately to the chief of the General Staff in Berlin. As a fighting soldier he viewed his staff suspiciously. He thought they might attempt to supervise or even take over. Rommel's behavior is understandable. He was an officer of the middle class who had made his way without patronage. Despite his incredible achievements in World War I, he had never gained admission to the General Staff. Had it not been for Hitler, who was quick to spot talented, young nonconformists, Rommel may not have been transferred from the infantry and given an armored command. Differences in breeding and temperament easily could have driven Rommel and his General Staff assistants apart. Even though he did not initially want the services of two of his principle staff officers, Westphal or Mellenthin, Rommel came increasingly to depend on them. They ran his headquarters, releasing him from the drudgery of staff work. They allowed him to concentrate exclusively on operational matters. Tireless and talented, they possessed the qualities Rommel prized most highly: loyalty and efficiency. His main military virtues were physical courage, imagination and

skill. He could be scathingly rude to timid commanders, but never rude to his soldiers or to his prisoners of war (POWs). His troops, both German and Italian, would literally do anything for him. Even British soldiers admired him so openly that their high command was forced to order its officers to stop discussing Rommel. Rommel insisted his officers eat troop rations, even though they were permitted to mess separately. This often amounted to only stale, wormy bread, washed down with a cup of brackish water. Only when British depots were captured did the *Afrika Korps* eat well, as did the POWs.

(2) General Hermann Balck. If Rommel made impossible demands on his staff, Balck was the soul of tact and reason. In late 1942, Mellenthin became chief of staff of the 48th *Panzer* Corps, in which Balck commanded the 11th *Panzer* Division. He was with Balck almost continuously from December 1942 until the end of 1944, from the Battle of the Chir River near Stalingrad to fighting with Army Group G in France, near the West Wall. With over 12 years of combat experience between them, Balck and Mellenthin operated on a basis of unlimited mutual confidence. Taking turns touring the forward edge of the battle area, they agreed that successful *Panzer* tactics depended on streamlined communications. This meant jointly working out a battlefield appreciation every 12 hours. Because of the enormous pressures of the Russian Front and his high confidence in Mellenthin, Balck took only five minutes of briefing from Mellenthin. Based on jointly developed plans emanating from these twice-daily meetings, Black issued oral orders to Mellenthin, who in turn passed them to subordinate commands -- to be passed on orally. At no time did Mellenthin's corps staff consist of more than three general staff officers (operations, intelligence and quartermaster).

Balck was steadfast, cool under fire, and inflexibly determined...a highly-gifted *Panzer* general. Of Swedish-Finnish ancestry, Balck was nicknamed the "cool Nordic" by Mellenthin. He was one of the coolest commanders under fire Mellenthin had seen -- absolutely unshakable. He was also the supreme realist. He demonstrated this on 30 December 1941, while briefing Hitler on the situation west of Moscow. Balck's briefing took 2 hours, during which time the *Führer* hardly interrupted. He advised Hitler not to withdraw under any circumstances. He reasoned that, with snow two meters deep and the temperature at 50 degrees below zero celsius, it would be impossible to retreat or even prepare new positions. Balck and Hitler then

got into an argument over tank losses, which Hitler had minimized. They compared numbers. Balck told Hitler point-blank that his tank figures were wrong. The main value of Balck's realistic analysis was twofold: it bolstered Hitler's decision to stand fast at Stalingrad (some strategists say it was the only correct decision under the circumstances) and it forced Armaments Minister Albert Speer to increase tank production.

It was Balck who stopped the Soviet break-through at the Chir River a year later in December 1942, wiping out Marshal Romanenko's 5th Tank Army. It was Balck again at Tatinskaya when German *Panzers* wiped out the Soviet 24th Tank Corps. It was the Nordic who boldly attacked the entire Russian 5th Shock Army under Popov, destroying it. This was achieved despite superior Soviet numbers of 11-to-1 in infantry, of 7-to-1 in tanks, and of 20-to-1 in guns!

(3) General Heinz Guderian. Guderian was brave, brash, bold -- and difficult; at one time he locked up Mellenthin for speaking too bluntly to Guderian's emissary. He was known affectionately to his men as "Papa Heinz" or "*Schnelle* Heinz" (fast-moving Heinz). It was Guderian's tanks that made the motorized dash to Vienna in 1938, and his formations that slashed through eastern Poland. Finally, it was his thrust to the coast at Abbeville in 1940 that cut the Allied armies in two. Guderian continually reinforced the hard core of armor, keeping firepower and mobility concentrated, never dispersing his tanks. Mellenthin insisted that Guderian, in so doing, created not only a new combat arm, but a new technique of command. Guderian was best known to the Allies as Germany's creator of the *Blitzkrieg*. He was a doer. It was he who took the theories of J.F.C. Fuller, B.H. Liddell Hart, and Charles de Gaulle and put them into practice. He was headstrong and opinionated. This was because he had formulated a new method of warfare, and impatiently wanted to see it translated into action. He wanted to drive right to Moscow, without all of Hitler's costly side trips. Guderian understood Clausewitz's advice regarding maintenance of objective. He placed heavy burdens on his staff. He was virtually impossible to reach as he led from the front. He had a talent for falling out with colleagues, senior generals, field marshals -- even Hitler. Like Rommel, he was a soldier's soldier, always ready to face danger, to set a personal example, to lead from the front.

c. The Leadership and Command Style

The division commander made his decisions in brief discussions with only one man in the division -- the Ia, or operations officer. There was no assistant division commander and no chief of staff. The division commander commanded, the Ia attended to the details of staff work, and the artillery commander coordinated fire support. [Ref. 172] The German style was one of a fluid offensive order of battle which demanded great initiative on the part of its leaders. The division commander, in his written order for the attack, would issue mission-oriented tasks to subordinate commands. While this is a style of command it is also a form of communication. It communicated the mission, which in essence set the boundaries for subordinate commanders. How the subordinate commander was to accomplish the mission was entirely up to him, within the limits of the resources allocated.

German *Panzer* division commanders had a direct relationship with their subordinate commanders. Rommel would accompany the spearhead of the advance or personally go back to bring up a tank company for reinforcement. The German commanders were aggressive and placed themselves well forward. The compactness of the German staff permitted commanders to place themselves forward to achieve insight into the uncertainty, chance, and danger of combat and enabled them to monitor the fatigue of the troops. This allowed them to maintain the initiative and thereby reduce the unpredictability of war. [Ref. 173] The division was not slowed by friction, over-planning, and debate in the staff. The commander's will dominated the scene and not the bureaucratic, decisionless presence of the staff. [Ref. 174]

When chaos developed, the German military system dictated initiative on behalf of the commander to resume the attack, to keep the enemy off balance through rapid tempo and surprise. A good example of this, and Rommel's genius, happened on 16 May 1940 in France. The 7th *Panzer* Division had contact with its neighboring units to the north and south only through radio transmissions, and 32.I.D (32nd Infantry Division), now approximately 45 km behind the 7th, really could no longer be considered a "neighboring unit". Since the onset of darkness on the evening of 16 May 1940, radio contact between the division commander up front with the tanks of *Panzer* Regiment 25 was broken with the operations staff of the division and

the artillery and *Schützen* Brigade 7 (a headquarters element controlling *Schützen* Regiments 6 and 7). The situation developed into an impressive illustration of the chance and uncertainty of war -- essentially chaos. Rommel's boss, *General der Infranterie* Hermann Hoth, who commanded the German 15th Motorized Armored Corps (XV.A.K. (mot)) was also out of contact with Rommel. He ordered the 7.Pz.D. to resume the attack against Avesnes at 0800 17 May 1940. Though still out of communication with the rest of his command, Rommel remained in touch with reality. With his characteristic initiative, he resolved to continue the attack to the west with the entire division before the break of day. He intended to seize the bridge over the Sambre River at Landrecies 18 km farther to the west and hold it open for the rest of the German Army. [Ref. 175] His plan: keep the enemy off balance, even though out of touch with higher headquarters.

Rommel could make relatively fast decisions -- decisions that also reflected the realities of combat at the crucial point in the battle. The road to military hell is probably paved more thickly with missed opportunities than any other factor. Rommel let few combat opportunities slip away. [Ref. 176] Funck, who commanded the 7th *Panzer* Division after Rommel, also had great resolve and wasted few words in assigning tasks. He showed confidence in the initiative of the subordinate commanders, and came to grips with the reality that no plan survives first contact with the enemy. [Ref. 177]

d. General Officer Casualties

German general officer casualties [Ref. 178] were staggering and severely strained the German command and control system. This drain on leadership averaged one corps commander killed every three months and a division commander killed in action every three weeks. The following tables reflect general officer losses by grade and position:

GENERAL OFFICER COMMANDER CASUALTIES [Ref. 179]
(World War II)

GRADE	NUMBER KILLED
Colonel General	1
General of Infantry	19
Lieutenant General	55
Major General	61
TOTAL	**136**

Table 3

POSITION	NUMBER KILLED
Army Commanders	3
Corps Commanders	23
Division Commanders	110
TOTAL	**136**

Table 4

The Germans placed great emphasis on their leaders positioning themselves well forward, which added to combat effectiveness by cutting through uncertainty in war. The forward military commander influences troop morale and his loss can be sorely felt. It is apparent from the casualty figures that the general officer in command billets took heavy losses leading from the front but contributed to the special tempo of German attacks.

e. The Awards System

The German Army placed a premium on officers who visualized their actions in terms of enhancing the success of the next higher command's overall mission. The exploits of a unit were important only in terms of their contribution to the overall victory of the army in battle. Except on exceedingly rare occasions, German private soldiers were not awarded the *Ritterkreuz* (Knight's Cross). The German Army awarded the Knight's Cross almost exclusively

to officers, based on its resolute and consistent logic that the higher decoration reflected action affecting the accomplishment of the general mission. [Ref. 180]

f. The Communications

German communication transmissions were short and to the point and are an indication of how well the German army mastered its profession. German control concentrated on communicating the intent of the commander. German methods of training and discipline were so effective that communications lent themselves to implicit rather than explicit orders. This reduced the need for direct supervision and mutual adjustment which aided standardization. The following are examples of message traffic within the 7th *Panzer* Division during its campaign into France in May 1940.

7.Pz.D. Message

Date	Time	From - To	Message Wording
13.5	0640	S.R.7 to T.Pz.D.	0600 S.R.7 *Maas Uberschritten* (7th Motorized Infantry Regiment crossed the Maas River at 0600.)
13.5	0730	7.Pz.D. to Pz.A.A.37	*Gefangene zur Division* (Prisoners to the Division)

German officers sent these messages during the tense hours of the assault crossing of the Meuse (Maas). The messages show a remarkably stark and streamlined style. They also show that the officers writing them shared a common, no-nonsense, operational language. In this succinct style the unit commanders often addressed themselves directly to the division commander. [Ref. 181]

Rommel originated a unique system of directing the units of the division by means of what he called the "*Stosslinie der Division*" (thrust line of the division). The division Ia designated the thrust line for given time periods and directed the maneuver of subordinate units of the division along it. The Ia always designated the thrust line in terms of a beginning point and an ending point clearly identifiable on the operations maps. The thrust line would begin most often

with zero and always be marked at one-kilometer intervals for its entire length. The division units would talk to one another in terms of locations along this line. [Ref. 182] This line communicated to subordinate units the intentions of the division commander and focused the efforts of the division. It also gave a quick, secure means of grid location and directing the fires of artillery. More importantly, it was offensively oriented.

The German *Wehrmacht* used rapid tempo to keep the enemy disoriented and force him to conform to the German order of battle at all times. The German methods of giving orders aided them in de-stabilizing the enemy. Orders were given orally and seldom written out. They had a tendency to be brief and starkly to the point. Oral orders aided the German concept of confronting uncertainty with action and seizing opportunity when opportunity presented itself.

Schwerpunkten and mission-oriented tasks were other forms of control measures which communicated the intent of commanders. They were control measures because they focused the efforts of a subordinate commander and at the same time allowed the commander freedom of action in accomplishing his mission. These control measures provided the respective commanders with specific guidance as to his mission, and again gave the commander the flexibility to complete the mission using his own initiative, based on available combat power.

The Germans used light signals as a common means of communicating important, time-sensitive information. On the first day of war against the Soviet Union, the 7th *Panzer* Division designated white star clusters from the flare pistol as the signal to mark the front lines of the 7th *Panzer* Division in the ultra-fluid conditions of the first hours of combat. The light signals were an instantaneously effective way of alerting general and private soldiers alike to momentary certainty in a sea of doubt. The *Luftwaffe* dropped red parachute flares over Soviet tank assembly areas which were discovered near Jarcewo in close proximity to 7th *Panzer* Division units and unknown at that moment to the ground troops. The *Luftwaffe* used the same signal later in July 1941 to immediately alert troops of the 7th *Panzer* Division as to the danger of Soviet tanks already advancing towards German lines. Green star clusters were often fired from the ground towards the enemy to indicate the German front line for the *Luftwaffe*.

2. The German Organizational Design for Combat

a. Occupying Enemy Territory

The extraordinarily quick defeat of the Western Allies at the hands of the Germans in the French Campaign began on 10 May 1940 and did not involve much fighting beyond 17 June 1940, the day on which Marshal Henri-Philippe Pétain asked the Germans for an armistice. The attackers actually won the campaign in a much shorter period of time in terms of the turning point. The Germans, in fact, had shattered the allied defenses on the continent when they forced crossings of the Meuse (Maas) River at several points on 13 May 1940. The Germans, in effect, won the Battle of France in four days, as marked by the crossing of the river barrier and the immediate exploitation of that achievement, by spearheading advances deep into the Allied rear with catastrophic effect. [Ref. 183]

The German's march into France was impressive. The French Army was considered by many to be the best on the face of the earth before World War II. The terrain in France was wooded and hilly and its natural barriers, such as rivers, would hinder any army's advance. The German gains were amazing. For example, on 20 May 1940, the 7th *Panzer* Division, from 0100-2400, advanced from Cambrai to an area just west of Arras. It moved an impressive 40 km and 27 km were gained in approximately 1 hour and 50 minutes when Rothenburg, in command of the 25th *Panzer* Regiment, crossed the *Canal du Nord.* [Ref. 184] These gains characterized the tempo of the German advance.

The 7th *Panzer* Division made even more impressive gains in Russia under Funck. Funck closed the northern arm of the envelopment and effected the encirclement of immense, strategic-scale Soviet forces in each of the three great battles of encirclement on the road towards Moscow in 1941. In four short days, 22-25 June 1941, the 7th *Panzer* Division would move more than 345 km through the Soviet Union, cutting the main road and rail connection between Minsk and Moscow at Smolevice, 30 km east of Minsk. [Ref. 185] Different than in France, the Russian terrain, with its open flat plains, lent itself to mechanized warfare, of which the Germans were the masters at this time. Later encirclements, area covered, prisoners captured, and resources destroyed or captured are a testimony to the viability of the German command and control.

b. Destroying Enemy Resources

On 27 June, the 7th *Panzer* Division would link up near Minsk and close the outer arms of an encirclement that would net 324,000 POWs and 3,332 destroyed tanks. They would again move 365 km, cutting the main road and rail connection between Smolensk and Moscow at Jarcewo, 55 km east of Smolensk, on 16 July 1941. Over the next few days, elements of the *Panzer* Group operating farther south would link up between Smolensk and Jarcewo and effect an encirclement that would produce 310,000 POWs and 3,205 tanks. Starting to advance on 2 October 1941, the 7th *Panzer* Division would reach the northern outskirts of Vyasma 106 hours later and link up a short time afterwards with the 10th *Panzer* Division to effect the immediate encirclement of 55 Soviet divisions. An ensuing battle would yield an additional 660,000 POWs and 1,242 tanks in pockets at Vyasma and further south at Bryansk. [Ref. 186]

c. Operating on a 24-hour Clock

The Germans fought 24 hours a day, day in, day out. They consistently reached their targets early in the evening, reorganized and advanced towards the next day's target, approximately in the middle of the night. They then would form another battle group for the next operation. They did roughly as much fighting and moving at night as during the day. [Ref. 187] How is it possible for the troops to handle the stress, and more importantly, the lack of sleep and physical exhaustion? The Germans apparently did so without any "doctrine". It is assumed that sleep was taken whenever and however possible. It is known that short periods of sleep (20 to 30 minutes) can be restful and help to counterbalance the loss of the normal eight hours.

d. Exploiting Success and Keeping the Enemy Off-Balance

Rapid tempo was the key to the German successes. The only way to exploit this concept was continually to be on the offensive. The German Army moved 24-hours a day and took every advantage it could. When supplies were low, it often attacked. When there was uncertainty, the Army kept the initiative. To stop or be stopped was to dance with defeat. Delays gave the enemy time - time to regroup forces, time to make credible defenses, and time to regain psychological balance. Rommel knew this when halted in France by rivers, success depended on a special tempo of operational movement. Immobility and a well-advertized

presence made the division a magnet for enemy reserves and accompanying counterattacks. [Ref. 188] Funck knew that accelerating the tempo of the attack was more important than waiting for the whole division to be concentrated or allowing a marginal supply situation to dictate a halt [Ref. 189]. The tempo had to be rapid to exploit success and keep the enemy off-balance.

e. Exploiting Enemy Resources

In an effort to maintain the momentum, the Germans would stretch their own resources to a dangerously low point. In one such instance, Funck was more willing to advance 40 km and chance running out of fuel, trusting to some opportunity to keep up the tempo, rather than to sit in position and wait tamely for resupply. At the last minute, a Soviet fuel dump was discovered and the leading regiment quickly fueled and set off after its advanced detachments. [Ref. 190] The Germans were able to capture large amounts of Soviet fuel supplies in Vilna and Molodecno, which aided the German drive into Russia.

f. Utilizing "Fight All Weapons" Concept

This concept, though not specifically addressed, nonetheless was recognized. The idea naturally goes with task-organized, mission-oriented orders and battle groups. This is further supported by a word the Germans used for advanced detachment - *Vorausabteilung* (advance detachment). At its very roots it implies maximum use of resources available and was a concept employed by the Germans to suggest a special psychological significance. [Ref. 191]

In France, the French "heavy" tanks proved to be a problem for the Germans. The French tanks were probably the 32-ton *Char* B-1 *bis* or 20-ton S.O.M.U.A 35. These tanks had armor on both hulls and turrets, varying from 40mm-60mm, making them too heavily- armored to be penetrated by either the antitank guns or the tank cannons of the 7th *Panzer* Division. The Germans had to depend on hits on the track system, "lucky" impacts against the junctions of turrets and hulls jamming the turrets, and similar types of impacts to disable these vehicles. In this uncomfortable situation, the Germans survived largely by flexible employment of the heavy *Flak* weapons and 105 mm artillery howitzers of the division in direct fire against the tanks. [Ref. 192]

The Germans had a *S.J.G. Kompanie* (or heavy infantry gun company) which was a special unit of 150mm "infantry guns" or, quite simply, infantry manning artillery pieces. The guns were mounted in armored boxes on the tracked chassis of the *Panzer* I 5-ton training tank of the 1930s [Ref. 193]. These guns were employed normally with mechanized infantry or tank units. They lent weight to the main attack, provided a punch to the front lines, and broke up enemy defenses.

The commanders of the 7th *Panzer* Division employed 20mm and 88mm *Flak* cannon against enemy infantry and tanks. The heavy *Flak* employed by the division scored impressive successes against the French and Soviet heavy tanks; and, light automatic *Flak* units proved effective against Soviet infantry and the lightly armored T-26 infantry support and BT-5 and BT-7 fast tanks. The Germans faced a difficult dilemma by placing the *Flak* cannons in an antitank/antipersonnel role; the greater the success of *Flak* against tanks and infantry, the less it would be available to carry out the primary mission of shooting down enemy aircraft. The Commanding General in a directive of July 1941, summed up (unwittingly) the German situation by admonishing the division commanders for excessive casualties among *Flak* crews that had been pushed to the front in various crises against tanks and infantry, and warning them to save the *Flak* units for air defense. In a flexible turnabout in the last paragraph, however, he stated that tank attack, more than any other factor, could result in the destruction of the division and that every *Flak* unit available would be pressed into use for the defense of the division in such circumstances -- so much for priority. [Ref. 194]

Working systematically in the 1930s, the Germans had developed the famous 88mm *Flak* 36 technically into a dual-purpose cannon. It is less well-known, that the Germans had employed the cannon in the Polish Campaign in an experimental, heavy, antitank battalion to test the tactical potential of the weapon in ground combat against armor. By the time of the French Campaign, they were ready to use the weapon against both types of tanks. Based on experimental shooting against the Czech fortifications in their possession after October 1938, they were ready to employ it against modern, steel-reinforced concrete fortifications. The 7th *Panzer* Division was very successful in employing its *Flak* cannons against allied tanks in the West in 1940 and even greater successes against Soviet tanks and infantry in the East in 1941.

[Ref. 195] It was not the technical superiority of the 88mm that made so awesome, but the superb tactical employment of it. The Germans proved capable of extracting extraordinary results out of their weapons.

3. The Organizational Decision Making

The decision making of the Germans can be defined as a management science because of the relationship between the German General Staff and the Commander, due in large part to their training. The two had a high degree of goal consensus and an understanding of what was required in the performance of not only their duties, but each others, as stated earlier. There was a strong link between operations and certain German command practices: particularly the unusually powerful role of staff officers and the practice of giving generalized orders that allowed the subordinate a maximum of initiative. The Germans termed this practice *Weisungsfuehrung* or "leadership by directive". An important extension of the practice of *Weisungsfuehrung* was the practice, in extraordinary circumstances, of granting to a subordinate *Vollmacht*. *Vollmacht* means "complete power" in German. In civil life it can mean "power of attorney". A meaning very similar to *Vollmacht* is conveyed when the term "*carte blanche*" is used. In German military usage *Vollmacht* had a very specific meaning: giving a subordinate the right to issue directives (*Weisungen*) in the name of a superior officer. These command practices were developed to complement operations: a strong staff system, *Weisungsfuehrung*, and *Vollmacht* helped the German Army with problems that lay outside the realm of operations. In particular, these command practices helped the German Army to develop new tactics as the war went on. [Ref. 196]

C. THE SUBORGANIZATIONS OF THE 7TH *PANZER* DIVISION

1. The Maneuver Elements

a. The 25th Armored Regiment

Inside Russia, the 25th Armored Regiment was the key maneuver element and continued to be organized into three *Panzer* battalions [Ref. 197]. The 7th *Panzer* Division in Russia had a substantial total of 284 light and medium tanks, compared with the much smaller number of 170 used in France. German tank production remained very light at this

time. Many tanks had been lost and worn out in Poland, France and the Balkans, and the feeble *Panzer* I had been almost completely phased out of use. The 7th *Panzer* Division would fight the great battles of 1941 with an initial outfitting of 167 of the mechanically robust but battle-marginal Czech-manufactured 38 (t) tanks weighing only 11 tons and armed with a high-quality, but necessarily light, 37mm cannon. [Ref. 198]

b. The 6th and 7th Motorized Rifle Regiments

The 6th and 7th Motorized Rifle Regiments, along with the 25th Armored Regiment, were the most important maneuver elements of the division [Ref. 199]. The division was partially equipped with *Schützenpanzerwagen* (Armored Personnel Carriers). The 7th *Panzer* Division received the first of these vehicles on 1 March 1941 and agonized over the tactical employment of troops in them. The Germans faced the question of whether to develop tactics of fighting from the vehicles or deploying out of them and fighting with more conventional infantry tactics [Ref. 200] (i.e. fighting vehicles verses battle taxies). The division had self-propelled 150mm heavy infantry guns which were special artillery manned by infantry crews. [Ref. 201]

The division commander would place the 25th *Panzer* Regiment behind the 6th Motorized Infantry Regiment because of the known Russian practice of attacking with tanks against the rear elements of advancing German columns. Placed far enough back to be out of sight of the attacking Soviets, the 25th *Panzer* Regiment several times came to the assistance of the last battalion in the advancing column of the 6th Motorized Infantry Regiment and destroyed a large number of Soviet armored vehicles. Funck, in so doing, gave a green light to the 6th Motorized Infantry Regiment to advance with particular boldness because the motorized infantry had no fear of being "cut off" by the Soviet tanks with the 25th *Panzer* Regiment following. [Ref. 202]

c. The 7th Motorcycle Battalion

As noted earlier, the Germans had a special genius for putting together specially tailored *Kampfgruppen* that were an important part of the style of their warfare. During the strategic offensives of 1939-1941, the Germans constructed their mobile advances out of the fire and maneuver of continually changing battle groups, each with its own mission-oriented task,

resultant combat, and reformation into yet another combat group for the next task. [Ref. 203] The 7th Motorcycle Battalion had special capabilities in ground reconnaissance and screening and could be armed and manned to provide significant strength in offensive and defensive combat [Ref. 204]. The motorcycle battalion of the division was used almost exclusively by the division commander. He employed it, reinforced, as the advanced detachment of the division or as a characteristic, German-style, *Kampfgruppe* maneuver element. The division commander employed the 37th Armored Reconnaissance Battalion almost identically. The end result was every other German armored division of the day had essentially two reconnaissance or "advanced detachment" battalions. [Ref. 205]

d. The 37th Armored Reconnaissance Battalion

This battalion had the capability to conduct ground reconnaissance both in depth and breadth and to screen the movement of the division on the offense and defense [Ref. 206]. The 7th Motorcycle Battalion could be used in conjunction with the 37th or on a separate axes to provide the reconnaissance for two axis of advance; the two battalions, K.7 and Pz.A.A.37, were used somewhat interchangeably.

2. The Combat Support Elements

a. The 78th Artillery Regiment

As a result of experiences in France, the artillery regiment was reorganized. The regiment had one of its three light (105mm) howitzer battalions replaced by a heavy (150mm) howitzer battalion, for the same overall total of three battalions. [Ref. 207] The artillery proved particularly effective in disrupting and scattering Soviet tank units assembling for attack. At 2000 on 6 July 1941, German artillery fire, as observed through artillery observation aircraft, would "shoot up in flames" seven Soviet tanks in one assembly area. A Soviet prisoner, Captain Logwinoff, 22th Motorized Rifle Division, engaged in the fighting at Vitebsk, would note specifically that the 10 tanks of the division still running after the long march to Vitebsk were all destroyed by German *Flak* and artillery fire. [Ref. 208] The long-barreled 100mm guns of the regiment (attached from corps) were placed well forward. They could fire at great ranges in front of the regiments to stimulate panic, confusion and flight

among Russians caught completely off-guard due to their assumed safe distance from the front. [Ref. 209]

b. The 58th Pioneer Battalion

The 7th *Panzer* Division found during the French campaign that the pioneer battalion with its one, older, "B" style bridging column was not able to react effectively enough for Rommel in the rapid pace of the division across the numerous Belgian and French rivers and canals. They wanted the battalion reequipped with two "K" type bridging columns [Ref. 210] to facilitate rapid river crossings. The Germans developed a 16-man pneumatic rubber raft and a nine-man wooden assault boat for pioneer units in support of river crossings. The 7th *Panzer* Division found the large boat with its 5,500-lb. capacity extremely useful in the numerous river and canal crossings and recommended that the boats be issued to the motorized rifle regiments and the motorcycle battalions. The big pneumatic boat, although oared by a crew of seven, could be equipped with a motor and proved to be extremely successful as a ferry with several "lashed together" to carry trucks, guns, and supplies. Oars proved effective at several junctures in the war when engines on assault boats could not be used because of the absolute tactical necessity to achieve surprise at night or in the fog. [Ref. 211]

c. The 42nd Antitank Detachment

The German 37mm *Pak* was useless against the Soviet heavy tanks but was capable of destroying the lighter BT-5 and BT-7 fast tanks [Ref. 212]. Funck often reinforced the tank regiment with an additional battery of *Flak* to be used in the fight against the Soviet tanks [Ref. 213].

d. The 59th Light Antiaircraft and the 86th Antiaircraft Gun Detachments

The light, automatic *Flak* units, like the 59th *Flak* Battalion, proved effective against Soviet infantry, light armored T-26, and fast BT-5 and BT-7 tanks [Ref. 214]. The Army 86th Antiaircraft Gun Detachment had organic 88mm and 20mm guns. The 88s were extremely effective against Russian armor. They proved to be the decisive weapon in stopping the heavy Russian T-34 tanks when the tanks were first employed.

3. Non-organic Combat and Combat Support Elements

a. Attachments

The 7th *Panzer* Division received support from high headquarters when needed. For example, in France, the division was supported in the initial assault by a complex array of army artillery detachments, corps artillery, *Luftwaffe Flak*, and an attached infantry regiment that would advance initially across one-half of the front. The division would move into the Soviet Union with attached corps troops that would remain with the division for long periods of time in 1941. It would request, receive, and operationally control a 100mm gun battery, two 150mm guns, one 210mm mortar, a smoke regiment (with 100mm conventional mortars), a self-propelled antitank company (47mm AT guns on *Panzer* I chassis) and strong pioneer detachments. [Ref. 215]

b. Air Support

The 7th *Panzer* Division had an army aviation detachment with light, fixed-wing aircraft dedicated primarily to reconnaissance [Ref. 216]. The *Stuka* (*Junkers* 87 B-1 and similar B-variants) aircraft were used to break up strong attacks by mechanized forces. The Germans used *Stukas* in close air support. This is not the close air support we understand today, but a systematic bombing ahead of the advancing columns to crystalize the enemy defenses so they would crumble before the ground attack. In this role, the *Stukas* were viewed more as air mobile artillery.

The 7th *Panzer* Division received strong air support from the *Stuka* dive bombers directed against artillery positions, tank assembly areas, and columns of tanks and vehicles on the road. The German air attacks took place at least a kilometer or more away from the positions of their own troops. Interrogations of prisoners showed that the German air attacks disrupted Allied road movements and silenced artillery, the latter effect often due to the *Stukas*. In the East, German air attacks broke up potential Soviet tank attacks by disorganizing strong armored formations in their assembly areas and reducing artillery fire to acceptable levels or silencing it. Soviet prisoners consistently reported having experienced attack against their units on the move and at train stations, and noted their forces were disorganized and scattered. [Ref. 217]

c. Supply

Unlike in France, supply proved to be more difficult in Russia. In spite of the months of preparation for Barbarossa, the gigantic surge of the German Army and *Luftwaffe* ground forces across the border overloaded the road system and blocked the movement forward of the fuel and ammunition columns of the division supply service. As early as 0530 on 22 June 1941, the Ia of the 7th *Panzer* Regiment ordered two heavy columns of fuel and one light column of ammunition forward for the 25th *Panzer* Regiment. Both the Ia and Ib personally intervened to get the fuel and ammunition forward, unsuccessfully. They only were able to get supplies to the *Panzer* regiment and the rest of the division around Olita in the early morning of 23 June 1941, approximately 24 hours late. The 7th *Panzer* Division learned from this experience to include fuel and ammunition columns in and among the forward elements. [Ref. 218]

D. ANALYSIS OF GERMAN LOGISTICS/SUPPLY INSIDE RUSSIA

"Operation Barbarossa" was planned to defeat the Soviet Army before the winter of 1941-42. Logistics for "Operation Barbarossa" simply were not an issue. This is not to say that the German Army did not experience problems in supplying war: they did. With well-known attention to detail, the *Wehrmacht* had planned and had the resources available to accomplish its objective of the defeat of the Soviet Union on a timetable of approximately 10-17 weeks. The German Army was operationally and logistically capable of defeating the Soviet Army, had Hitler not intervened. The efficiency of the German Army's organization for combat is reflected in the concept of the "Divisional Slice".

1. The "Divisional Slice"

While manpower shortages for frontline units plagued the Allied armies, their logistic trains remained virtually untapped sources of men and material. In this regard, it is interesting to compare the "divisional slice" of the Allied, German, and Russian armies. A rough and ready method of measuring the efficiency of an army organization, the "divisional slice" is determined by dividing the total number of men in an army by the number of divisions it fields. Simply put, it is the total number of personnel required to man, supply, and keep a division in action. For the Canadian Army, the figure was a weighty 93,150: for the British Army, 84,300; and for the

more affluent United States Army, a lower 71,100. A certain amount of interpolation is required before a meaningful comparison can be made since Canadian divisions with strengths of 18,376 (infantry) and 14,810 (armored) were larger than their American equivalents of 14,037 (infantry) and 10,670 (armored). Still, whatever the measurement applied, no nation needed so many men to keep one man in action as did Canada. Taking the fighting arms all together, in the Canadian Army they made up but 34.2 percent of the whole, while the American and British Armies constituted 43.5 and 65.3 percent, respectively. [Ref. 219]

By contrast, the German Army "divisional slice" was roughly 23,000, based on an average divisional strength of 12,000. This meant that a Germany of 85 million inhabitants could mobilize 325 divisions, while an America of 140 million barely could maintain 89 divisions. The Soviets, with divisional slices of 22,000 and a population exceeding 170 million, could field better than 500 divisions with average strengths of about 10,300 each. [Ref. 220]

This shows the efficiency and level of commitment of the warring countries. In particular it highlights just how streamlined the German Army really was and emphasizes the efficiency of its small logistical tail. A streamlined German Army with the initiative on the offense was on the verge in 1941 of winning the whole war. With an offensive style perfectly adequate to accomplish that goal and a logistical tail that would sustain it through some of the most bitter fighting of the Second World War.

2. Hitler's Redirection of the German War Effort

The German Army essentially lost the war by the end of August 1941 with Hitler's redirection of the German war effort into the Ukraine and a longer campaign than had originally been planned. Dr. Russel H.S. Stolfi presents a convincing argument that had the German Army not been redirected southward into the Ukraine and continued its main effort with Army Group Center, in all probability the German Army would have won the war in the late summer of 1941 [Ref. 221]. With the same effort that was redirected by Hitler into the Ukraine but hypothesized as directed eastward, the German Army more than likely would have advanced through Moscow (their objective) and beyond to Gorki, thereby seizing not only the main population center of Russia but the industrial and communications centers as well, causing the collapse of Soviet mobilization. That they did not is a result of Hitler's interference.

Wars are won or lost based on the ability of an army to plan or account for all factors in advance, thereby adding dimension to the attacking force and increasing its dynamic response. If an army plans to a point on the ground, then the army more than likely will advance only to that point and little farther. The momentum of the attack is lost, thereby demotivating the attacking force and eventually defeating it. If an army fails to plan or account for one or more factors in its environment, then due to an unforseen circumstance or a lack of foresight these factors become additive and work against the attacking force. It is from this point that criticism can be leveled against the loser. Such was the case with the German Army in Russia.

The German command and control system had well over a year to plan for "Operation Barbarossa" and ensure logistics as well as lines of communications were secured or accounted for in advance. The unforeseen circumstance was Hitler redirecting the German war effort at the beginning of August 1941. Intending to defeat the Soviet Union by the end of the summer 1941, the German Army did not plan winter war. The partisan activity, the time given to the Russian Army to recover, the vastness of Russia, the fact that railroad lines are inflexible and the Russian road system would not support relatively high-speed truck transportation all came together to present difficult challenges to an army that had planned quite effectively for a campaign of 10 to 17 weeks and found itself in a war that lasted for 200 weeks.

In "Operation Barbarossa" the Germans had enough artillery ammunition to defeat the Soviets in the war. After "Operation Barbarossa", the Germans never really had enough artillery (and the other resources of war) to do the job (that is why never intended to). But they were so effective in "Operation Barbarossa" that the relatively frail *Blitz* logistics system was surprisingly effective for four years of attrition-style, ground-slogging warfare. [Ref. 222] Even in the absence of sound defensive doctrine, as discussed in Chapter VI, the dynamic response of the German Army's command and control system allowed the Germans to continue the war for four more years, a profound accomplishment with all the military force and resources of the Allies against the German Army. The rest of this chapter analyzes the German Army's ability to supply war in the last phases as it relates to German command and control's ability to conduct war and the effects of climate on both the structure and the logistics.

3. German Logistics in the Defense Part of the Effort, August 1941 - May 1945

Amateurs talk strategy; professionals talk logistics. - Martin Van Creveld

This quote is aimed at the operational level of war. It matters little the aims of strategy if the means are not available. The same is true of tactics. Logistics empower a force for combat. Rommel drew the following conclusions:

> The first essential condition for an army to be able to stand the strain of battle is an adequate stock of weapons, petrol and ammunition. In fact, the battle is fought and decided by the Quartermasters before the shooting begins. The bravest men can do nothing without guns, the guns nothing without plenty of ammunition, and neither guns nor ammunition are of much use in mobile warfare unless there are vehicles with sufficient petrol to haul them around. Maintenance must also approximate, both in quantity and quality, to that available to the enemy. [Ref. 223]

4. The Problems of Supplying War

Although the number of armored divisions available for "Operation Barbarossa" had more than doubled (fifteen in May 1940; thirty-two in June 1941) the number of vehicles had increased by only a third (from 2,574 to 3,332). Hitler, aware of the importance of the armored thrust to the new campaign, had raised the number of *Panzer* divisions by the simple expedient of cutting in half the size of existing divisions, thus creating two divisions out of one. The regular formations, of course, retained the best of the equipment and parcelled out the remainder to the new units as these were formed. Those who were among the last to be raised were issued equipment of the most diverse nature. The 18th *Panzer* Division, for example, lacked all vehicles until June 1941, when French trucks were supplied. With no delay the troops were then carried straight from the 18th division's concentration area to the form-up zone, east of Warsaw, and put into action. When the division entered the fighting ii did so with 162 different types of soft skin vehicles, among the twenty-one major groupings of which it was composed. One of those groupings had seventeen different types of lorry within a unit establishment of thirty-three vehicles. The artillery regiment had 445 vehicles on establishment and there were sixty-nine different types of lorries. The problems of spares for these many different, and often unusual, types of machine can only be imagined. [Ref. 224]

There was one vehicle which was not included on the war establishment that was to be found in every unit. This was the Russian *panje* cart, a horse-drawn wagon, strongly constructed, light and extremely mobile. One transport officer was to remark bitterly,

> The *panje* cart was the only standardized transport we had, and that was not even an official issue [Ref. 225].

The German transport officer's frustrating remarks echo the problems of the German Army in supplying war. This ultimately influenced the day-to-day activities and limited German command and control's ability to conduct war properly with such logistical problems.

German soldiers fought without winter clothing or special equipment simply because the German supply system could not transport the items forward from rear depots. Normal winter-issue items for the soldiers were stocked in Germany and Poland. The German logistical system, already tottering from the strain of providing fuel, food, and ammunition to three army groups over the primitive Russian transportation net, was brought to the brink of total collapse by the arrival of winter. Sporadic partisan activity and an epidemic of locomotive breakdowns greatly curtailed German rail-haul capacity. Losses of motor vehicles and draft horses further snarled supply distribution, and frantic attempts to press Russian *panje* wagons into service provided little immediate relief. Besides, the severe cold increased the consumption rate of certain commodities. For example, German soldiers used large quantities of grenades and explosives to fracture the frozen earth to create makeshift foxholes. Also, fuel consumption did not decline in proportion to vehicle losses since drivers idled their motors round-the-clock to prevent engine freeze-up. [Ref. 226]

The limited transportation space was devoted to such vital cargos as ammunition and medical supplies because the supply lines could not handle all the supplies that the German Army needed. Since winter clothing is inherently bulky and therefore required much space to transport, it remained, for the most part, crated in warehouses in Poland and Germany. German soldiers had to fend for themselves as best they could. Even with the Soviet winter counteroffensive in full swing, cold weather casualties exceeded combat losses in most German units. [Ref. 227]

5. Lines of Communication within Russia

The German soldier perhaps thought of Russia as having the same road and rail system as their own. Of course, they reasoned, the primitive Slavs would not have an autobahn like Hitler's Germany, but a usable road system must certainly exist, or so they thought. Instead of a vast network they found that the number of all-weather roads in western Russia could be counted on the fingers of one hand and that these roads converged upon Moscow, the Soviet capital. They then discovered that most roads, except for only a few highways, were turned into impassable mud tracks following only moderate rain fall, that surfaces became deeply rutted through the weight of traffic, that they were completely impassable in winter and were sandy, engine-scouring, dust traps in the summer. The railway, the only other main source of communication, was just as inadequate. Not only were the main lines few and the branch line system poor, but the whole railway network used a broader gauge than that of western Europe, a difference that brought a tremendous strain upon the small amount of rolling stock that the Army was able either to seize or to adapt. [Ref. 228]

E. ANALYSIS OF RUSSIAN TERRAIN/CLIMATE

1. The Russian Terrain

The Russian country into which the German armies advanced was a vast land mass made up of every type of terrain. From the pine-forested emptiness of northern Finland the line ran through the wide expanses of Russia's western border zone. Much of that region was covered by almost impenetrable swamps. South of this and crossing the wide and monotonous Steppes of the Ukraine the land changed and was succeeded in the extreme southern part of the battle front by the sub-tropical climate and terrain of Georgia and the Caucasus. Across whole regions of the line from Finland to the Caucasus were deep forests of great density. The presence of the natural obstacles of mountain, desert, marsh and jungle forced the German armies into predictable routes of advance and it was to break through these passages, defended by the Red Army, that many of the bloodiest battles were fought. [Ref. 229]

General Greiffenburg, once Chief of Staff of the 12th Army, made the following appreciation of the terrain he faced in Russia:

> East of the Bug-San line in Poland terrain conditions and the shortage of roads restrict movement . . . the rivers often overflow and cause widespread flooding. This disadvantages become more pronounced the farther east one penetrates, particularly in the marshy, heavily-forested regions of the Pripet marshes and the Beresina river . . . [Ref. 230]

This could be applied to many regions other than the one about which the General was reporting.

The German Army, which had prepared for a short war, was expected to use equipment designed for western Europe against the Soviets in a variety of Russian terrain [Ref. 231]. There were maize fields of unimaginable size and immense forests that were like jungles in the density of their tangled undergrowth. There were woods of such impenetrability that most German troops could advance scant hundreds of meters into them. The German soldiers were unprepared for marshes that form one of the outstanding natural obstacles of the central and north-western republic of Byelo-Russia; marshes so great in extent as to be as large as two provinces of their German homeland. They found rivers lacked banks and were prone to flood with waters that swept across the flat, monotonous landscape, increasing for months at a time the already vast marsh area. [Ref. 232]

2. The Climate of the Russian Interior

The Germans, like most people everywhere, were generally ignorant of the Soviet Union. They knew that geographically it was a vast territory covering nearly one sixth of the land surface of the globe, but in Russia they were unprepared for the depression that was engendered by the realization of its terrible vastness. They were unprepared for fields of sunflowers that went on for kilometer after weary kilometer; solid blocks of color stretching forward to the distant horizons. [Ref. 233]

In Germany there were cold winters and hot summers but not the extreme differences in temperature encountered in the Soviet Union; the bitter cold of thirty or forty degrees below zero, the searing heat of summer when temperatures rose to unbearable levels: both were strange phenomena. One question posed in post-war years was whether the appalling hardships suffered by the German Army during the first frightful winter might have been avoided or at least

minimized had the Russian road and rail system been more widespread. This would have aided them in checking the great Soviet winter offensives. Climate may have been a series of natural disasters, but these might have been less disastrous had a competent road and rail system existed, or had the German engineers built such a system. [Ref. 234]

Even by Russian standards, the 1941-42 winter was particularly harsh. From December until early March, military operations were hampered by heavy snowfall and by the few hours of winter daylight. Yet the extreme cold was by far the most significant aspect of the winter weather. During the winter battles, German and Russian forces clashed in temperatures routinely ranging from -10^{0}C to -30^{0}C, with brief cold spells exceeding -40^{0}C. Contrary to German belief, the cold was an impartial adversary that dogged the operations of both sides with equal intensity. Still, the Germans were generally more vulnerable to the debilitating effects of the subzero temperatures due to a near-total lack of winter clothing and equipment. [Ref. 235]

The German regiments on the open Steppes of Russia were the victims of every catastrophe from frostbite to pneumonia and typhus because the Germans lacked efficient channels to support their armies. This was compounded from long retreating through waist high snow where progress could be as little as five kilometers in a day and enduring attacks by wave after wave of well-equipped and warmly-clad Siberian riflemen who, completely at home in the sub-zero temperatures, swept out of a blinding snowstorm to harry and to kill. [Ref. 236]

IV. GERMAN ARTILLERY AND ITS EARLY HISTORICAL DEVELOPMENTS

If a modern artilleryman were to journey back to the First World War around 1918, he would be surprised to find German firepower employed in a manner amazingly consistent with today's principles. The driving force behind this revolution in German artillery tactics was an obscure, retired lieutenant colonel named Georg Bruchmueller. The German infantrymen he supported had a nickname for him that was a combination pun on his name and the German word for breakthrough, *durchbruch*. They called him "Der Durchbruchmueller" [Ref. 237].

Like his immediate superior, General Oskar von Hutier (who had done for infantry tactics what Bruchmueller had done with artillery tactics), he was able to synthesize the lessons learned from previous battles and was able to utilize artillery more effectively and make it a more vital and decisive force. The American Civil War, along with other wars, lent itself to the study of infantry as well as artillery tactics and the application of those tactics to future wars. These lessons and tactics were not lost on LtCol, later General, Bruchmueller.

The American Civil War emphasized the fact that artillery, like all arms, needed direction and unity of effort to be effectively utilized. Bruchmueller realized that planning for artillery fire had to be centrally controlled (at artillery headquarters) to be effective in the offense due to the unfamiliarity of enemy position and the terrain and the lack of mobile communication. It was not until technology improved communications that greater flexibility would be achieved.

A. THE AMERICAN CIVIL WAR

1. Direct-fire Artillery and the American Civil War

Throughout the American Civil War, artillery on both sides dominated the battlefield. Gunners employed artillery in a direct-fire mode, often positioned forward of the infantry. Although both sides had many rifled field pieces the unreliable fuzes

negated their effectiveness. Smoothbore guns firing solid shot and canister provided the most effective fire support [Ref. 238]. Against massed infantry formations, solid shot was deadly. The "cast-iron bowling ball" ricocheted through the formation, shattering equipment and bodies, turning them into secondary projectiles. At closer ranges, canister rounds turned the smoothbore cannon into a giant shotgun. At ranges less than 400 yards, its effect was devastating [Ref. 239].

With extended range (over 1,600 yards for a 12-pound smoothbore), artillery was a potent combat force for the maneuver commander. However, not all commanders understood how to employ their guns effectively. Artillery batteries belonged to the brigade and division commanders. Early in the war, both sides discovered that technology had outpaced much of the traditional artillery doctrine. Infantry with rifled muskets could effectively engage targets at ranges of 400 meters or more. Maneuver commanders who wheeled artillery forward to engage the enemy often lost their gunners before they could begin effective fire. Moreover, the handling of individual batteries by various brigade and division commanders precluded the benefits of massed artillery fire. By the end of 1862, both sides had taken steps to consolidate control of the artillery at the army level [Ref. 240].

2. The First Fire Support Coordinator of the Union Army

On 21 July 1861, Henry Hunt found himself in command of four 12-pound, smoothbore cannons protecting the left wing of General McDowell's advance at Bull Run. Despite the Union rout, Hunt's steady performance in support of the withdrawal caught the attention of Union leaders. One such officer, General George McClellan, named Hunt the chief of all artillery in the Army of the Potomac. For the first time in the Union Army, this established the relationship between the Fire Support Coordinator (FSCOORD) and the maneuver commander. Under McClellan, Hunt not only controlled the reserve artillery, but also gained positioning authority over brigade- and division-level batteries. The Union Army began to benefit from the increased coordination of fire support almost immediately [Ref. 241].

General Hunt's success at Malvern Hill as well as his direction of long-range fires at Antietam earned him the reputation as the finest artilleryman in the Army. Unfortunately, not all maneuver commanders accepted his role as senior FSCOORD. When General John Pope took the Army of the Potomac to fight General Lee at the second Battle of Bull Run, he left Hunt and the Artillery Reserve behind. The Union Army's subsequent inability to mass or coordinate its fires figured in still another disastrous defeat [Ref. 242].

The initial employment of Union artillery at Fredericksburg again reflected the positive impact of coordination. General Hunt's support of the river crossing was a model for such operations in the future. However, when General Burnside prevented Hunt from moving the artillery forward, his maneuver units soon moved out of effective range. Union infantry attacking the stone wall before Marye's Heights lacked the suppressive firepower artillery could have provided. Thirteen thousand Union infantry died in unsupported attacks against the Confederate position [Ref. 243].

3. Chancellorsville

Shortly after Burnsides' debacle at Fredericksburg, President Lincoln turned the Army of the Potomac over to General Joseph Hooker. A competent corps commander at Antietam and Fredericksburg, Hooker made a number of positive reforms in the Army's organization. With a corps commander's outlook, however, he eliminated General Hunt's control over individual artillery batteries. Once again the infantry commanders controlled the artillery [Ref. 244].

At Chancellorsville, fire support was as good or bad as the individual battery commander. There was no central control, planning or coordination. Some artillery units performed admirably. For the most part, Union artillery suffered from poor placement and a lack of coordination with the infantry. Without prioritization or target guidance from a higher level, many batteries expended all ammunition during their first engagements. Hooker's decision to ignore the advice of his senior artilleryman resulted in defeat at Chancellorsville [Ref. 245].

4. Gettysburg

If any battle of the American Civil War reflected the ideal employment of the senior artilleryman as FSCOORD, that battle was Gettysburg. After Chancellorsville, Hooker restored the authority and responsibility to General Hunt's position. When General Meade took command of the Army of the Potomac on 28 June 1863, he retained Hunt as Chief of Artillery [Ref. 246]. When General Meade arrived on the evening of July 1st, the battle had already begun. Skirmishes between Union cavalry and Confederate infantry early that morning had escalated into a major battle between the two armies [Ref. 247].

As Chief of Artillery, General Hunt traveled with Meade. Their action upon reaching the battleground was to inspect the field together. In this way, Hunt not only got a clear feel for the terrain, but also an understanding of how Meade wanted to conduct the defense. For his part, Meade instructed Hunt personally to supervise emplacement of the artillery batteries. This was one commander who understood how valuable his FSCOORD could be. By now there was no challenge to Hunt's authority regarding control of the artillery [Ref. 248]. As the battle progressed, Hunt used artillery to plug gaps as they developed in the Union's line. Understanding Meade's concept, he was able to make decisions without waiting for the commander's approval. First on Culp's Hill, then in front of General Sickle's exposed salient, Hunt positioned artillery to counter potential enemy success. By the end of the battle's second day, Union artillery had prevented disaster on more than one occasion. The final challenge came on the third day in an attack that has become known as Pickett's Charge [Ref. 249].

Once again, General Hunt's grasp of Meade's plan for the defense enabled him to provide superior fire support. Both officers anticipated General Lee's final assault against the Union center. Hunt positioned his artillery along Cemetery Ridge and on Little Round Top so as to hit the attackers from both the front and flank. His artillery reserve provided additional guns and ammunition that were vital to this battle. When the initial Confederate barrage began, Hunt gave specific attack guidance to his batteries.

Although they responded with counterbattery fires, Union artillery fired slowly and deliberately to conserve ammunition. Hunt further anticipated Meade's order by shutting down the counterbattery fire early to save ammunition for the infantry assault [Ref. 250]. In the hope that their artillery had silenced Union guns, the Confederate infantry began its attack. As the waves of gray advanced steadily across the open field, they were met by a hail of round shot from Union batteries. As the range closed, Union cannons switched to canister and tore gaping holes in the Confederate formation. By the time the remnants reached the Union position, the attack's momentum was already spent. The Union gunners had crippled the assault before it could be driven home [Ref. 251].

By understanding the maneuver commander's intent and working closely with him, Hunt's coordination of artillery was decisive. He provided the expertise and experience that guided emplacement of Union batteries where they were most effective. At Gettysburg, he incorporated sufficient flexibility into his fire support plan to be able to shift batteries to meet crises as they developed. Because he understood what the maneuver commander wanted, he was able to coordinate the fire support without constantly checking with Meade [Ref. 252].

B. THE FRANCO-PRUSSIAN WAR, 1870-1871

The Franco-Prussian War was the first one on the European continent to use fully the new infantry weapon technology. Armies of both sides equipped their soldiers with breech-loading rifles, accurate to about 1,200 yards. The French also fielded the *Mitrailleuse* that had 37 rifled barrels, similar to a Gatling gun. These weapons proved especially deadly to artillerymen. Though artillery weapons had a range of approximately four miles, both sides used direct fire. The improvements in infantry weapons made exposed artillerymen easy targets [Ref. 253].

The Germans, victors in this war, took home several lessons. The first was the importance of medium and heavy artillery to attack enemy trenches. Second, they learned the effectiveness of breech-loading rifles and artillery pieces. Third, the Germans learned

they needed to develop a system of indirect fire to take advantage of the increased range of the artillery and improve its survivability [Ref. 254].

German artillerymen immediately began developing a system to direct the fires of their batteries from behind cover. They became the first army to produce a gun-mounted sight, the *Richtflache*, that they used to orient the battery and lay the guns. Combining this sight with standardized correction procedures, telephone links and maps, the Germans soon had an accurate system of indirect fire. By 1896, indirect fire became the accepted means of attacking targets [Ref. 255]

C. THE RUSSO-JAPANESE WAR, 1904-1905

Impressed by the increased artillery capabilities that technology offered, a Russian artilleryman named G. Guk foresaw and wrote about the advantages of indirect fire in 1882. His work impressed many Russian artillerymen who subsequently became interested in the German artillery model. They quickly adopted and improved the German artillery sight into their own version called the *Uglomer*. Armed with ideas and a basic sight, the Russian artillery began to experiment with indirect fire at their schools [Ref. 256]. Russian artillery officers soon became very proficient at methods of indirect laying, even practicing on moving targets. They developed a method to lay and orient their guns with all guns on line, using one aiming point. This method was fast, simple and automatically resulted in parallel lines of fire. It's also interesting to note the Soviets use this same method to this day [Ref. 257].

Despite this training, Russia entered the Russo-Japanese War lacking the confidence to use indirect fire in combat. They weren't convinced of its feasibility until the Japanese effectively used it against them during the first battle of the War. German officers had trained the Japanese artillery and given them the equipment necessary for indirect fire [Ref. 258]. The Japanese used gun sights, angle-measuring aiming circles and aiming stakes to orient their guns. Japanese forward observers used a bracketing technique of adjusting with one gun, then firing for effect with the battery. The effectiveness of the Japanese artillery taught the Russians a costly lesson. The Russians quickly saw their

error and began using indirect fire. Because of their peacetime training, the Russians showed a high degree of proficiency. Thus the Russo-Japanese War became the first in which both sides engaged in duels with indirect artillery fire [Ref. 259].

D. THE RELUCTANT USE OF TECHNOLOGY

Either ignoring or disbelieving the lessons of the Franco-Prussian War, the British began the Boer War (1899 to 1902) using the traditional forward emplacement of artillery and had to change procedures [Ref. 260]. They compounded their mistakes when they incorrectly assumed that the Boer War was atypical of future wars and, except for the Royal Garrison Artillery, abandoned indirect fire afterwards [Ref. 261]. This reluctance to use indirect fire as the standard method of fire originated from several prejudices. The first was the classic distrust of any new technique. Artillery and maneuver commanders felt it would take away both their control and fire support. Artillerymen, enthralled by the romantic vision of artillery up front, felt indirect fire placed them in inglorious positions. Another major source of reluctance came from senior officers too stubborn to admit that advances in technology demanded changes in doctrine [Ref. 262].

The German artillery took to heart the technical lessons from the previous wars to reinforced their conviction. The majority of German artillery were heavy and medium batteries which used forward observers to adjust fires in the First World War. This technique proved very successful against Allied artillery and trenches, especially during its initial stages. Nevertheless, the Germans employed their light artillery in the same manner as the French (forward emplacement) with the same unfortunate results [Ref. 263]. It wasn't until Bruchmueller was recalled to temporary active duty that light artillery was included and the German Army would revolutionize its artillery tactics.

E. ARTILLERY AND TRENCH WARFARE OF WORLD WAR I

When World War I started, neither side envisioned the almost four years of fighting from fixed positions that would follow. Despite the technical lessons learned in the recent Russo-Japanese and Balkan Wars, infantrymen and artillerymen still seemed determined to fight separate battles. The linear mass attack formations used since Napoleon's day could not stand up against the withering fire that technology had now provided. Unable to survive on the surface of the earth, the troops started digging. Firepower had gained the upper hand over maneuver, and the result was trench warfare [Ref. 264]. The machine gun contributed to the stalemate, not just because it increased firepower but because it increased defensive firepower more than it increased offensive firepower. The countermeasures to defensive fire took longer to develop [Ref. 265] Meanwhile, special emphasis was placed on obliterating the enemy's fortifications. Artillery was even expected to cut enemy barbed wire. The prevailing philosophy became "The artillery conquers, the infantry occupies" [Ref. 266].

The key technique in this new form of warfare was the artillery preparation. Military leaders convinced themselves that the more high explosives they dumped on the objectives, the easier the infantry's job would be. In truth, the long preparations accomplished very little. They actually caused more problems for the attacker by creating more obstacles, tearing up the terrain, and sacrificing surprise. The apocalyptic battles of 1916 and 1917 finally exposed the bankruptcy of the destruction-by-artillery doctrine [Ref. 267].

F. OBSERVED FIRE DURING WORLD WAR I

During World War I, field artillerymen experienced the first real opportunity to employ indirect fire extensively. Too dependent on good communications and forward observers (FOs) seeing the target, observed indirect fire quickly fell out of favor. The smoke and dust on the battlefield made detecting targets difficult, while shelling cut telephone wires and hampered communications between the observer and the battery [Ref. 268]. To overcome these problems, combatants developed unobserved or map firing

by which targets were first located on a map. This technique depended on sound- and flash-ranging and aerial observation to adjust artillery fire on to the targets. The guns then could fire on targets without depending on the eyes of FOs and good communications [Ref. 269].

Field artillerymen also designed rolling barrages of high-explosive rounds and shrapnel to furnish close support for the infantry plus standing barrages of various kinds to neutralize enemy batteries or other targets. These fires minimized the need for observed fire [Ref. 270]. For the most part, a rolling barrage moved faster than was planned for the infantrymen because of the shell-pocked ground and obstacles that hampered their movement. This left the infantry without adequate close support, allowing the enemy to wait in trenches until the barrage passed and then pop up to cut down the infantry with small-arms and machine gun fires [Ref. 271].

Despite the problems with observed fire, some field artillerymen persisted in using it and had some success. Neil Fraser-Tytler, a British battery commander of 18-pounders, was one of these. Bored with unobserved fire, he enjoyed creeping at night into "no-man's land" to find a crater from which he could adjust fire on enemy targets [Ref. 272]. Fraser-Tytler demonstrated this type of fire could be effective and could be shifted around the battlefield as needed to neutralize targets and furnish close support for infantry [Ref. 273]. Indirect artillery fire had one overwhelming advantage: it was much less vulnerable to the enemy's counterbattery fire. In fact, artillery firing indirectly could silence artillery firing directly, as was proven during the Russo-Japanese War at the battle of Sha-ho on 1 September 1904 [Ref. 274].

At the end of the First World War all participants were well-schooled in the advantages of indirect fire. They had learned methods to orient, mass and control fire and the devastating effects of indirect fire on their soldiers. More importantly they experienced the clash of technology and tactics with its inevitable result: modification of current tactics [Ref. 275].

G. THE CONCEPT OF MASSING FIRES

The concept of massed field artillery originated while it was still a direct-fire system. Napoleon employed his Grand Battery at Wagram and Waterloo, hoping to gain in massed firepower what he had lost in trained infantry. At Waterloo, the French artillery massed 80 guns virtually hub-to-hub. The crashing volleys of massed artillery created gaps in the opposing line that the infantry or cavalry could exploit [Ref. 276]. In the American Civil War, both sides massed artillery hub-to-hub to attain fire superiority. By World War I, field artillery became an indirect system, but it retained the concept of mass. The artillery of that war lacked the technical capability to converge fires on a single target, but the prolonged heavy bombardments clearly reflected an appreciation for the effects of massed fires. By 1916, artillery fires lasting several weeks before a major attack were not uncommon [Ref. 277]. During the interwar period, increased control was developed in artillery units. This increased the artillery's ability to mass its fires and improved radios allowed reliable communication between observers and the firing battery [Ref. 278].

H. THE GERMANS RESTORE MOVEMENT TO THE BATTLEFIELD

The static World War I pattern finally was broken on the Eastern front when the Germans executed the War's first successful large-scale penetration against Russian prepared defenses and followed up by exploiting it. On 1 September 1917, the numerically inferior German 8th Army under General Oskar von Hutier forced a crossing of the Dvina River, drove three divisions through the entrenchments of the Russian 12th Army and captured the Baltic port of Riga. The German success resulted from the aggressive application of new tactical concepts for both infantry and artillery [Ref. 279].

Hutier's artillery played by an entirely new set of rules. Rather than firing a preparation for days or even weeks, the prep lasted just five hours. It may not have been long, but it was incredibly violent and the Germans used a high percentage of chemical rounds. Rather than throwing the rounds down-range indiscriminately, the Germans used

artillery against carefully selected targets. This diabolical firestorm was the brainchild of Hutier's Artillery Chief, Lieutenant Colonel Georg Bruchmueller [Ref. 280].

I. LTCOL GEORG BRUCHMUELLER'S INFLUENCE ON ARTILLERY

1. LtCol Bruchmueller's Influence On German Artillery

> I considered him an artillery genius. He had the gift, which I found in no other artilleryman, of instinctively knowing how much of which type of munitions to throw at a position in order to soften it up. The troops realized very quickly that under an artillerymen of Bruchmueller's capability, artillery preparations for the attack were more reliable; and they went forward with a fuller sense of confidence when Bruchmueller and his staff were in charge. General Max Hoffman
> Chief of Staff, Eastern Front

2. The Artillery Tactics of Bruchmueller

a. Synchronizing Fire with Maneuver

Bruchmueller became a specialist in the preparation of artillery bombardments designed to enable large-scale infantry offensives to succeed [Ref. 281]. He was a most unlikely innovator in a war infamous for its lack of innovation. German artillery was organized into two different branches. The Field Artillery was mounted and directly supported the maneuver units, primarily using light guns. The foot artillery manned fixed fortifications, didn't have organic mobility and used heavy howitzers and siege mortars [Ref. 282]. The two branches were barely on speaking terms. Field artillerymen looked down on the foot gunners as "dugout artillerymen". Bruchmueller should have fit right in with the mentality of blindly blasting away with more and more artillery given his background as a dugout artilleryman--but he didn't [Ref. 283].

Bruchmueller commanded 30 German batteries in the repulse of the Russian attack at Lake Narotch in March 1916. The Russians suffered an estimated 90,000 casualties, due in large part to Bruchmueller's guns. In April 1917, he commanded the artillery in the German counterattack at the Toboly Bridgehead [Ref. 284]. His performance earned him Prussia's highest military decoration (the Blue Max) and brought him to the attention of General Max Hoffman, Chief of Staff

of the Eastern Front. Hoffman put Bruchmueller in charge of the artillery of the 8th Army even though he was still only a retired lieutenant colonel on temporary active duty [Ref. 285].

b. Neutralization and Gas Warfare

> We desire only to break the morale of the enemy, pin him to his position, and then overcome him with an over-whelming assault.
>
> Colonel Georg Bruchmueller

Bruchmueller was one of the first great practitioners of neutralization. Realizing the counterproductive nature of the long preparations, he understood that duration of fire mattered less than strength and intensity. The shock effect of a barrage is greatest during its first few hours. After that, the impact tends to wear off, and the troops being shelled develop a mental resistance to its psychological effects. He saw no sense in continuing to throw shells after that point. Bruchmueller also understood the problems that heavy use of high explosive created for the attacker [Ref. 286] who had to negotiate shattered terrain.

Neutralization implied better coordination of the artillery and the infantry. This coordination was hard to achieve. The infantry actually had to be in place, waiting to rush the enemy defenses just as the artillery fire lifted. Confusion, mud, obstacles and enemy fire might prevent that. For neutralization to work, the artillery had to fire close to its own infantry without hitting it. There could be no good communication between the infantry and artillery, as artillery fire quickly cut telephone wires. The infantry and the artillery had to do everything by timetable [Ref. 287]. Bruchmueller did not even try to use artillery to cut barbed wire. Sappers accompanying the infantry handled those obstacles [Ref. 288].

Gas, as well, was the perfect neutralization tool, and the German Army had a well-developed array of chemical rounds from which Bruchmueller could draw (see Table 5). Persistent gas used against enemy artillery positions eliminated the gun crews and contaminated the position and equipment, making it difficult, if not impossible, for replacement crews to put the guns back into action. Nonpersistent gas used against the

enemy's front-line positions and timed to dissipate as attacking units arrived could neutralize the enemy without the mobility impediments of high explosive fire [Ref. 289].

STANDARD CHEMICAL ROUNDS USED BY THE GERMAN ARTILLERY IN WORLD WAR I

SHELL MARKING*	EFFECT	CHEMICAL	DURATION & LETHALITY
White Cross	Lachrimator (tear)	Tear Gas	Nonpersistent Nonlethal
Blue Cross**	Sternutator (Vomiting)	Arsine	Nonpersistent Nonlethal
Yellow Cross	Vesicant (Blistering)	Mustard	Persistent Low Mortality
Green Cross	Asphyxiant (Choking)	Phosgene Chlorine Lewisite	Nonpersistent Lethal

* The German marking system for chemical rounds was adopted by the Allies, to a large extent.

** Most Allied masks were ineffective against Blue Cross. Bruchmueller's technique was to fire mixed Blue and Green Cross. Blue Cross made it almost impossible to keep a mask on in the presence of the lethal Green Cross.

Table 5

c. Task Organization

One of Bruchmueller's innovations was a system of task-tailoring artillery to support specific operations. To the irritation of the hard-line traditionalists, he completely ignored the distinctions between foot and field artillery and built his task groups and subgroups with whichever batteries he needed to accomplish the mission [Ref. 290]. He organized the majority of the artillery-controlled assets into counterinfantry (IKA) and counterartillery (AKA) groups. About five percent of his guns

went into special long-range groups (FEKA) for deep targets or heavy groups (SCHWEFLA) for special missions. The infantry-controlled assets included trench mortars (*Minenwerfern*) and specially designated batteries of accompanying artillery (*Infantriebegleitbatterien*) [Ref. 291].

During the preparation, the artillery controlled the trench mortars, which fired exclusively on the enemy's leading positions. During the assault, the trench mortars reverted to infantry control (See Table 6). In the Riga attack, for example, Bruchmueller allocated 116 of his 170 batteries to three IKA groups and 36 batteries to one AKA group (See Table 7 and Figure 4) [Ref. 292]. In its fully developed form, a Bruchmueller bombardment had three phases. The first phase was the sudden opening of fire on all parts of the enemy defensive system: infantry positions, artillery batteries, mortar positions, command posts, telephone exchanges, camps and staff quarters. The intent was primarily to shock and demoralize the enemy, as well as to cause some destruction. In the second phase, most of the German artillery shifted to concentrate on the enemy artillery. Long range guns continued to shoot at camps, villages, and staff quarters in the rear. Generally the German artillery left the foremost infantry positions alone during this phase, although some guns might bombard infantry portions toward the rear of the defensive system, in order to disrupt the movement of possible enemy reinforcements. The third phase involved a systematic bombardment of the forward infantry positions just prior to the assault, while keeping the enemy artillery and rear installations under fire [Ref. 293].

BRUCHMUELLER'S ORGANIZATION OF ARTILLERY FOR THE ATTACK

Functional Group*	Mission	Controlling Echelon	Comment
<u>Arty Assets</u> IKA (Infantrie-bekaempfungs-artillerie)	Close Support	Attacking Division	75% Arty Assets - 1 Group/Div - Subgroups Organized by Task
AKA (Artillerie-bekaempfungs-artillerie)	Counter Battery	Corps	20% Arty Assets - 1 Group/Corps
FEKA (Fernkampf-artillerie)	Deep Battle	Corps	Long-Range Guns - Command, Control and Communication Targets - Flank Targets - Rear Lines of Communication - Reserves
SCHWEFLA (Schwereste Flachfeuer-artillerie)	Special Destruction	Army	Heavy Guns - Hard Targets - Bridges - Command Bunkers
<u>Infantry Assets</u> MW (Minenwerfern	Close Support	Div Arty -during the prep Infantry Bns -during the assault	Trench Mortars - Enemy Front Trench line - Machine gun Emplacements
IBB (Infantriebe-gleitbatterien)	Accompanying Artillery	Attacking Division	Light Fieldguns - Didn't Fire in Prep - One Bn/Div, if available

* Groups were not fixed organizations. Each group and sub group was configured from varying numbers of batteries to accomplish specific missions for each operation.

Table 6

d. Technology

Bruchmueller seized every opportunity to use emerging technology to his advantage. He quickly recognized the potential of the airplane and used air observers for long-range adjustments and the acquisition of deep targets. He also viewed the need for the guns to register as a major handicap [Ref. 294]. Registration compromised surprise and gave away a battery's position, making it an instant counter battery target. Fire direction and survey techniques at the start of the war were just too primitive for indirect fire without registration [Ref. 295]. But Bruchmueller had the habit of getting intelligent and aggressive officers and NCOs for his staff. One of them, Captain Erich Pulkowski, eventually worked out a Met+VE (Metrological Data + Velocity Error--a method for getting muzzle velocity corrections without registration) technique based on the same concepts used today. The old hardliners bitterly fought against adopting the Pulkowski method, but by the start of 1918, Bruchmueller (still only a lieutenant colonel) forced the Germany Army into using it [Ref. 296].

ORGANIZATION AND MISSION OF GERMAN ARTILLERY								
Gps			MISSION	Field Guns	Heavy Guns	Light Field How	Heavy Field How	Hvy Arty Motr
AKA	A	A1	Neutralize the Enemy Artillery	5	5	-	2	-
		A2		6	-	-	1	-
		A3		7	1	-	-	-
		A4		7	1	-	1	-
IKA	B	B1	Lay fire on the first-line positions to prepare for the assault in the 19th Reserve Division's attack zone.	4	-	8	6	3
		B2	Lay heavy fire on the second-line positions to prepare for the assault in the 19th Reserve Division's attack zone.	-	-	3	3	-
		B3	Lay down a fire barrier to the east.	9	2	-	-	-
	C	C1	Lay heavy fire on the first-line positions to prepare for the assault in the 14th Bavarian Jaeger Division's attack zone.	6	2	7	10	5
		C2	Lay heavy fire on the second-line positions to prepare for assault in the 14th Bavarian Jaeger Division's attack zone.	2	2	3	3	-
	D	D1	Lay heavy fire on the first-line positions to prepare for assault in the 2nd Guards Jaeger Division's attack zone.	5	--	7	7	2
		D2	Lay heavy fire on the second-line positions to prepare for assault in the 2nd Guards Jaeger Division's attack zone.	1	-	5	3	-
		D3	Lay down a fire Barrier to the west and provide fire support for the 1st Reserve Division in case of a Russian attack.	6	2	-	-	-
			TOTAL	58	15	33	36	10
OVERALL TOTAL				152				

Table 7

e. Operational Security and Maneuver Coordination

Bruchmueller was a fanatic about operational security and coordination with the infantry before the start of the battle. His batteries moved only at night. Quite often they occupied presurveyed and prestocked positions within just a few hours of the start of a preparation. He used his own aerial observers to check the camouflage and track plan of his units [Ref. 297]. Before an operation, Bruchmueller

track plan of his units [Ref. 297]. Before an operation, Bruchmueller personally briefed the commanders and staffs of the supported units on the fire support plan. As his responsibilities grew and the task became more than one man could handle, he sent all his group and subgroup commanders out to brief the infantry. Bruchmueller expressed his philosophy on this point: "The thanks of the infantry must be treasured more by every artilleryman than all decorations and citations". For Bruchmueller, supporting the maneuver commander was of paramount importance [Ref. 298].

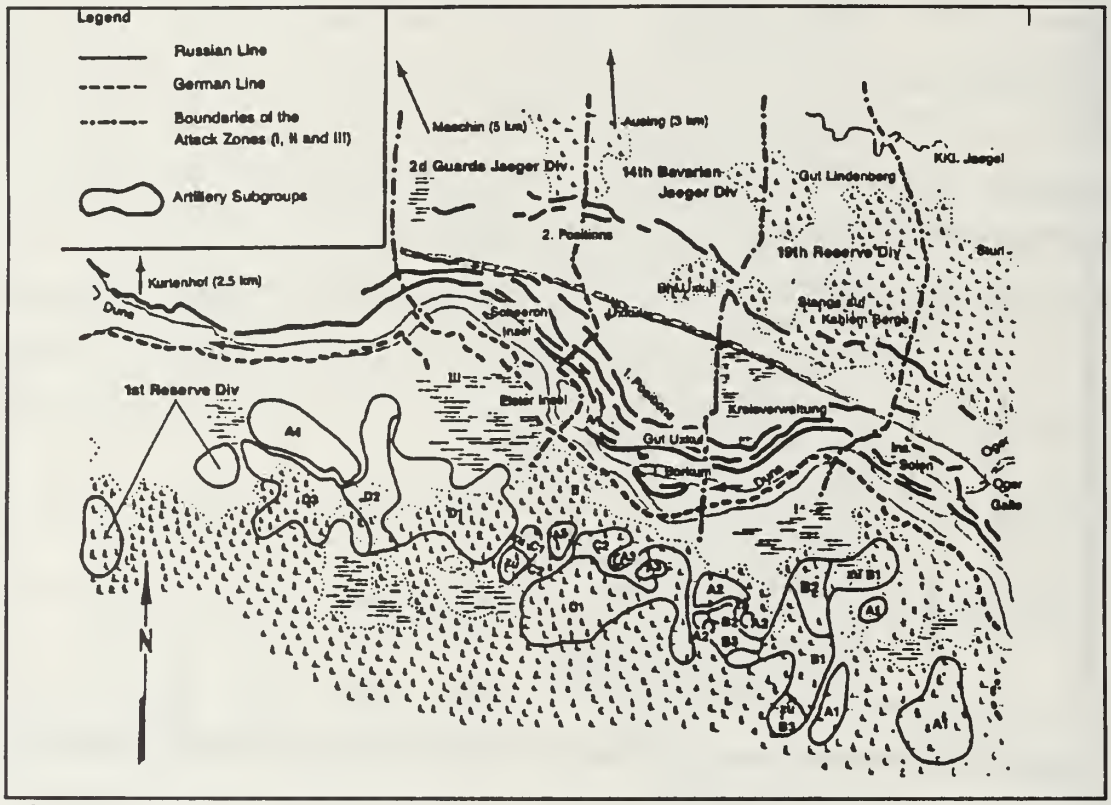

Figure 4 Bruchmueller's Positioning of Artillery near Riga to support the attack on 1 September 1917.

f. Artillery Preparations

Bruchmueller supported a preparation and a creeping barrage (*feuerwalze*) during the assault. Neither type of fire was new, but the way Bruchmueller used these techniques kept the enemy constantly off balance. He stressed short, three-phase preparations with minimal registration. As the war moved through 1918, Bruchmueller eliminated registrations altogether (using Met + VE), and the length of the preps

progressively decreased from five hours to just slightly more than two hours [Ref. 299]. Phase Three of each prep ended with all guns shifting to the enemy's leading positions for a 10-minute saturation (see Table 8). It didn't take the Allies long to figure out this was the signal for the start of the assault. Bruchmueller countered by inserting varying numbers of 10-minute shifts to the front targets in random spots in Phases Two and Three of the prep. He understood the psychological effects of artillery fire [Ref. 300].

BRUCHMUELLER'S FIRE PLAN TO SUPPORT THE ATTACK
Preparation Phase I (10 - 30 Minutes) -Surprise concentration (TOT) to draw enemy artillerymen to their guns. -No counterbattery fire. -Command posts, communication centers and troop concentrations specifically targeted -All guns fire with mix of 9 Blue Cross to 2 HE **Preparation Phase II (1.5 - 2.5 Hours)** -Reinforced counterbattery fire. -IKA reinforces AKA. -Mix of Blue Cross, Green Cross, HE and smoke. **Preparation Phase III (1 - 2 hours)** -IKA shifts back to infantry targets. -IKA fires 20% Blue and Green Cross to 80% HE. -AKA fires 75% Blue and Green Cross to 25% HE. -FEKA hits rear area command, control and communication targets and reserves. -All guns shift to enemy front-line infantry positions 10 minutes before the assault*. **The Assault** -Double creeping barrage. -Line of HE moves just ahead of attacking infantry at a rate of 40 to 50 minutes per kilometer. -Another line of Blue and Green Cross and smoke moves in front of the HE, at least 600 meters in front of the advancing infantry and timed to dissipate before their arrival. -AKA continues counterbattery fire. -FEKA fires Yellow Cross on flanks to isolate the objectives.
* Phases II and III of the prep were interspersed with random 10-minute shifts to front line targets just to confuse the enemy as to when the assault would actually start.

Table 8

J. GERMAN ARTILLERY DOCTRINE LEADING INTO WORLD WAR II

The main firepower of the German infantry division resided in its artillery regiment, which possessed one battalion of heavy 150mm howitzers and three battalions of medium 105mm howitzers. German artillery doctrine remained quite similar to World War I

doctrine, when both the Allies and the Germans utilized "indirect fire". Guns far to the rear fired at targets they could not see, adjusting their aim by means of radio and telephone messages from forward observers [Ref. 301].

1. Major General Rudolf Bleidorn, Artillery Inspector from 1927 - 1929

The most difficult task for the German artillery arm resulted from its expansion, beginning in 1927 from seven regiments to well over 100 regiments in 1940. The major figure behind this expansion was Major General Rudolf Bleidorn, who also kept his branch abreast of current technical advances. Although an Artillery Inspector only from 1927 until 1929, Bleidorn set the course for the development of German artillery through World War II [Ref. 302]. He and his successors emphasized rapidity of movement, rapidity of fire control adjustment, the importance of combined arms, and an excellent training program for artillery officers. During his tenure he began the motorization of the artillery observation troops and took the first step towards motorizing their guns. The shortage of motor vehicles prohibited the infantry division's guns from becoming motorized. Bleidorn also recommended the development of the light field howitzer 18 and the heavy field howitzer 18, the two artillery pieces that the army issued in 1935, which would serve as the backbone of the divisional artillery through World War II [Ref. 303].

2. Colonel Robert Martinek

The German Army had the luxury of possessing an artilleryman of international renown as both observer and participant in the French Campaign. As the last Inspector of Artillery of the Austrian Army, Col Robert Martinek had served as artillery commander of the VII Corps in 1940. He proved to be one of the most innovative minds in the service and later rose to the rank of *General der Artillerie*. He believed that many of the German Army's tactical errors resulted from careless map reading. It seemed to him that the infantry suffered too many casualties in attacking across open ground. Between the wars Martinek had made a science out of military topography, creating the unique training device of miniature artillery firing ranges. He

concluded that the German Army as a whole did not devote enough time before the attack to map reading. If done correctly, map reading would reveal not only the best route, but the probable enemy dispositions. Under his direction during the fighting, analysis of maps revealed the probable location of a French artillery observation post, which the Germans covered with smoke-shells, thereby neutralizing the enemy artillery [Ref. 304].

Martinek found other deficiencies in the German operations that resulted from insufficient training. He maintained that the inability of the infantry to deploy their heavy weapons correctly stemmed from the all too carefully prepared pre-war tactical exercises. In war the general confusion and quickly changing tactical situations rendered such training meaningless. In similar fashion, the infantry did not follow the artillery barrage close enough when attacking. Martinek lamented the dearth of World War I veterans who knew from experience that in the long run it was preferable to suffer a few casualties from one's own artillery and capture the objective, rather than attacking the same objective after repeated failure. He found the current employment of artillery forward observers to be rather poor. The artillery forward observers were directed to remain at the infantry company headquarters, from which they usually could not see any targets. The colonel suggested that greater care be taken to educate officers in the correct placement of their headquarters to solve this problem. The German Army also had experienced a problem with artillery employing smoke screens. The introduction of smoke shells shortly before the opening of the French Campaign did not give officers sufficient experience in concentrating the smoke. The colonel believed that these deficiencies could be corrected only by the use of more realistic training measures [Ref. 305].

K. GERMAN ARTILLERY AND THE LESSONS LEARNED IN CAMPAIGNS

1. The Polish Campaign

Brigadier General Friedreich Wilhelm von Chappuis concluded at the end of the Polish Campaign that the lack of discipline among the troops resulted from poor

leadership by the junior and mid-level officers. Such poor leadership led to numerous tactical errors and a general lethargy. Consequently, the German infantry lacked elán in the attack, letting tactical opportunities slip away while waiting for their artillery support or heavy weapons. Even when heavy weapons were on hand, they were frequently used incorrectly [Ref. 306].

General Fedor von Bock, Commander of Army Group B, reflected concern for training, when, on April 28, 1940, just days before the German invasion of France and Belgium, he delivered a final critique of the units under his command. Bock observed from the most recent training exercises that too many regimental and battalion commanders demonstrated an inclination towards cautious leadership. Such caution he believed created the danger that the German Army would miss many opportunities to take advantage of favorable tactical situations. Such missed opportunities would slow the troop's forward movement and give the enemy time to take appropriate countermeasures. Bock desired more aggressive combat leadership but did not signify that officers were to stop thinking and revert to the "attack-mania" that beset the officer corps in the late nineteenth and early twentieth centuries. Bock stated that fire superiority remained a prerequisite for victory. Officers must plan ahead and be prepared quickly to employ all the firepower at their disposal [Ref. 307].

2. The French Campaign

The German Army had a very healthy and objective habit of self-evaluation in an effort to hone their warfighting skills. Only six days after the capitulation of France, the German General Staff on 28 June 1940 issued a detailed questionnaire to each divisional, corps and army headquarters, requesting evaluation of their combat experiences. In light of the decisive German victory, one might expect a good deal of self satisfaction from the field commanders, not a few of whom were in line for promotion. But instead of painting a rosy picture of the army's performance, the field commanders and staff officers maintained the same critical detachment that marked their observations of the Polish Campaign [Ref. 308].

General Gunther von Kluge, Commander German 4th Army, and his Chief of Staff, Brigadier General Kurt Brennecke, stated that although the motorized forces had performed well in the campaign, the motorized infantry divisions were not tough enough and consequently lacked aggressiveness in the attack. They concluded that infantry divisions were too dependent upon their artillery and that the infantry should rely more upon their own heavy weapons (infantry guns and mortars). Such independence required additional training for officers and noncommissioned officers in combined arms operations. Kluge and Brennecke observed that the artillery too often relied upon methodically planned barrages, rather than properly using their forward observers to adjust fire as needed. The two generals stated that troops resorted to artillery interdiction fire on suspected enemy positions in the absence of accurate observation. They concluded that such interdiction fire was a serious error that resulted in the waste of much ammunition [Ref. 309].

Lieutenant General Kuno-Hans von Both, Commander of the Ist Corps, observed that the increased firepower of modern weapons dictated a version of World War I assault tactics. Both stated that the battlefield closely resembled a chess board, with individual assault groups winding their way forward by way of any terrain that would shelter them from enemy observation and fire. The German infantry deployed their heavy weapons and machine guns in the gaps of open ground between the advancing assault groups. Ist Corps found that special tools--explosives, grenades and machine pistols--were required for the infantryman to destroy enemy strong points. The assault groups also found it necessary to deploy individual 88mm guns or 105mm howitzers to reduce strong points with direct fire [Ref. 310].

General Kluge and his Chief of Staff, General Brennecke, echoed the widespread belief that the light infantry mortar should be discarded and replaced with the more effective 81mm mortar. They maintained that the regimental light infantry guns should be turned over to the infantry battalion's machine gun company, to be replaced by the heavy infantry cannon. Kluge and Brennecke believed each infantry regiment required additional specialized troops and equipment, which would necessitate the formation of an

additional battalion headquarters. They concluded that the inability of the 37mm antitank gun to knock out French tanks demanded its replacement with a more powerful gun mounted on a self-propelled vehicle. These self-propelled antitank guns would be issued to both the regimental antitank detachment and the divisional antitank battalion, which would receive a company of 20mm antiaircraft cannons. The two generals' most radical proposal consisted of an extensive expansion of the divisional artillery, which would receive a detachment of 88mm guns, an observation battery, and an artillery commander. They proposed motorizing the division's heavy artillery battalion and adding an additional artillery regimental staff [Ref. 311].

L. THE GERMAN AND BRITISH ARTILLERYMEN

Both the German and British artillerymen solved the technical problems associated with predicted fire at about the same time [Ref. 312]. The difference was that the Germans were better than the British at integrating their artillery fire plans with their infantry attack plans [Ref. 313] as the career of German artilleryman Georg Bruchmueller shows.

Bruchmueller's process was implemented because it worked. Although innovative in the employment of artillery, Bruchmueller was not primarily an innovator in the development of artillery technique. He did, however, play a pivotal role in the application of techniques developed by others. This was the pattern for some of the more important German doctrinal innovations of the war: local commanders tried out the new ideas on their own authority first. By the time the innovation became a matter of official policy it was already in general use and thoroughly field tested [Ref. 314]. The German army was famed for allowing subordinate commanders maximum latitude in carrying out their missions. In cases where more centralized control provided a better solution to the problem at hand, the General Staff always was ready to exercise centralized control. Flexibility was the keynote of the German command system, not rigid adherence to principles of autonomy for subordinates [Ref. 315].

Bruchmueller organized artillery support for a series of large-scale attacks. His basic technique was to keep the supporting bombardment as short as the artillery technique of the day would allow. He also maximized infantry/artillery cooperation. This is precisely what fighting through a World War I defensive system required [Ref. 316]. There were British artillerymen who could have done the same thing, indeed who did try to do so. The difference is that the German General Staff system allowed and encouraged Bruchmueller to do what he did, whereas the British General Staff system stifled the British artillerymen [Ref. 317].

V. GERMAN COMMAND AND CONTROL AND SUPPORTING ARMS

A. THE TACTICAL EMPLOYMENT OF GERMAN ARTILLERY

1. Infantry Guns

The idea of providing infantry with its own organic artillery was born during World War I with the introduction by the French of the 37mm trench gun [Ref. 318]. To begin an attack, the artillery provided rolling barrages of massed fires behind which infantry followed at a relatively close distance. What little coordination and control there was between the two arms rapidly deteriorated over distance due to a lack of man-portable communications. Attacking infantry was essentially without a form of flexible fire support. With the infantry gun, the artillery was simply taken forward with the infantry. This additional combat power lent weight to the attack, gave quick fire support and provided tremendous flexibility at precise points of need.

The infantry gun was considered during the 1920s by several armies (including Germany). The idea gained little acceptance outside the continent of Europe, mainly because of the improvement of the muzzle-loading mortar. The mortars generally were easier to transport, simpler to operate, had sufficient range for infantry needs, and usually had a higher rate of fire owing to the simple loading system. Mortar projectiles often caused more damage than their gun equivalents due to the mortar bomb's steep angle of descent and its higher explosive capacity--factors that combined to give particularly good fragment distribution [Ref. 319]. Recognizing these capabilities, the German army had numerous highly efficient mortars. Still, the German Army retained the infantry gun throughout the war. It formed a useful source of instantaneous fire support [Ref. 320], becoming the predecessor to self-propelled (SP), antitank and assault artillery.

2. Artillery Versus Armor

a. German Artillery and Russian Armor

Field Marshal Gunther von Kluge stressed the importance of training German troops to meet the particular problems presented in fighting the Red Army. The German Army would be expected to encounter large numbers of Soviet tanks. Many of the tanks were obsolete, but the Russians fielded a series of heavy tanks weighing close to 40 tons. German artillery was forced to deploy its batteries not only for normal fire assignments, but also in positions suitable for direct fire against Russian surprise tank attacks [Ref. 321].

b. The Introduction of the Russian T-34 Tank and its Effect on German Command and Control and German Artillery

In June 1941, Germany had 3,200 tanks for the advance into Russia and no reserves. Russia, on the other hand, had 10,000 tanks in the field and 10,000 in reserve. Despite this numerical superiority the Russians were unable to stem the German tide in the first phase of the War. At the beginning of October 1941, barely four months later, nearly 18,000 Russian tanks had been destroyed by German armor. This was not done by superior German armor, but by superior German command and control at the tactical level [Ref. 322]. The resurgence of the Russian armor effectiveness began when the Soviets started to use the T-34 tank in large numbers in late 1941. The T-34 immediately rendered most of German tank and antitank weaponry, including German artillery (due to low muzzle velocity), useless. Supported by heavy KV-1 or KV-2 tanks, the T-34 partly counterbalanced the superior German tactics and helped to check the German advance [Ref. 323]. Russian tank factories were able to turn out unparalleled numbers of excellent fighting machines which allowed the Red Army to mount a strategic offensive by the end of 1942 [Ref. 324]. It was the Russian tank force that eventually decided the war in Russia and established the Russian foothold in central Europe [Ref. 325].

c. *First German Encounters with the Russian T-34 Tank*

The first confrontation with the then unknown types of heavy Russian tanks took place in the first days of the war. The 6th *Panzer* Division had moved toward the Dvina River on the road to Leningrad near the Baltic. The division established contact with strong armored forces when more than 100 Russian tanks attacked it. This became the first crisis for the *Wehrmacht* on the Russian Front. The Russians attacked the rear of the Manstein *Panzer* Corps, which was spearheading the German thrust [Ref. 326]. Russian heavy tank forces overran the forward elements of the 6th *Panzer* Division [Ref. 327]. The Russian and German forces faced each other at a point-blank range of 100 meters. A fierce exchange of fire took place without any visible German success. The Russian tanks continued to advance through the German armor. All German tank and antitank run armor-piercing rounds simply bounced off the Russian T-34 tanks. The Germans were now faced with the alarming situation of the Russian armor rolling into the German rear combat zone [Ref. 328]. The German tanks turned around and rumbled backwards towards their own rear areas followed by the Russian tanks. The German armor succeeded in immobilizing some T-34s and KVs by destroying their tracks at very close ranges. German artillery and the 88mm *Flak* (antiaircraft) guns finally brought the Russian attack to a halt with both indirect and direct fire [Ref. 329].

d. *German Artillery Antiarmor Tactics*

German artillery delivered rapid and heavy concentrations of interdiction fires on the Russian armor which had broken through German lines. These interdiction fires were requested and adjusted by the forward observers (FOs) who accompanied the German armored battalions. A mixture of smoke and high explosive (HE) artillery rounds was used. While the HE could not destroy the armor, it immobilized some of the Russian tanks by destroying their tracks. The indirect fire forced the Russian armor to disperse causing loss of contact between the tanks. The Russian tank formations then became leaderless. The smoke ammunition markedly decreased the visibility range of the Russian armor crews. The next phase was the relatively close range delivery of a barrage fire

(just out of direct fire range) in front of each battery's firing position. The barrage fire missions were requested by a fire coordinator operating from an observation post (OP) established just forward of the artillery battery's firing position. When in range, the Russian armor would then be engaged by the direct fire of the German artillery. It then became necessary for the German soldiers to immobilize the Russian tanks at very close range with close combat weapons [Ref. 330]. This type of operation proved successful. The Soviet KV-1 and KV-2 tanks were enclosed by 80mm of armor and reinforced in places up to 120mm. They carried 76mm or 152mm guns as well as machine guns for close-in protection. These tanks were extremely rugged and could take severe punishment. For example, one Kv-1 tank bore the marks of 70 hits but not a single round penetrated. The only available weapons the German Army had which were capable of destroying these monsters at greater ranges were the 88mm air-defense guns [Ref. 331]. Because of the probability of frequent armored breakthroughs, the German artillery was forced to prepare itself for deployment in an antiarmor role. Of course the German artillery did not see its primary mission as being antiarmor. It became operationally necessary (and still is) to be prepared to fulfill these types of missions. After the initial surprise, adequate armor-piercing ammunition became available and the armored monsters were less effective. The German artillery became an effective antiarmor weapon when forced to act in such a role [Ref. 332].

e. The Defensive Techniques used by German Artillery

The German defensive operations were categorized by the tactical manuals as mainly a defense against armor. Artillery firing positions were to be organized to defend against and defeat Russian tank attacks. The artillery fires were to be integrated into the overall defense plan. Firing positions were to be echeloned in depth. Not only did this give depth to the defense but maximized the use of each artillery piece's on-carriage traverse limits for massing fires across adjacent sectors. It was paramount to reconnoiter probable enemy armor assembly areas as early as possible in order to cover them with interdiction fires. Artillery was to strip away the enemy infantry from their armor when the Russian attack did begin. By taking away the protective layer

of infantry, the Russian armor then could be destroyed by direct fire and close combat weapons. The artillery blocking fires or barrages (final protective fires) were to be delivered in front of German front lines. The Russians tanks that were successful in penetrating these front lines then could be covered by the artillery batteries that were scattered throughout the area of responsibility. After delivering barrage fires in front of their own positions, the penetrating Russian armor was to be destroyed by artillery direct fire in the artillery positions [Ref. 333].

(1) German Artillery Indirect Fire Command and Control Techniques. A typical towed artillery battery's position had a 500 to 600 meter field of fire. Each artillery piece had to use its on-carriage traverse limits to cover the battery's assigned area of responsibility sufficiently. Close range observers were placed just forward of the firing position. The prime movers were located about one mile to the side of the firing position. One prime mover was kept available 200 meters to the side of one howitzer. This one howitzer was on a standby basis for rapid displacement and special employment, perhaps against a single tank or small group of infantry threatening the flanks of the battery's position. Fire direction normally was carried out in such a way that the fire commands were given by the observer and transmitted by radio to the Battery Executive Officer. The Battery Executive Officer transferred the commands to the platoon leaders who in turn transmitted the commands to the section leaders [Ref. 334].

(2) German Artillery Direct Fire Command and Control Techniques. The commands for direct fire were given by the section chief. The Battery Executive Officer ordered only the distribution of fires with the separation line between the attacking tank formation. He then turned over the fire commands to the section chiefs. The section chiefs subsequently determined which tanks would be attacked by giving the range and the type of ammunition to be used [Ref. 335]. How the armor finally was to be destroyed was not predetermined by the tactical manuals because in each case it required a different course of action. Courage and the professional skills of leaders at each level were the best means for survival and success. The German artillery placed a

great deal of emphasis on direct fire training for all artillerymen. This type of preparation was the basis for German artillery success against enemy armor [Ref. 336].

(3) German Artillery Success Against Russian Armor. The reasons the Russian T-34 and other heavy tanks did not become a decisive weapon until later in the war varied [Ref. 337]:

- Soviet tank tactics were inferior to German tactics. They used their tanks piecemeal or for infantry support only, instead of using them massed at select critical points. They deployed them as a main effort weapon in order to tear gaps into the German front and wreck the German rearward communications and supply system by pushing recklessly deep
- into the German rear combat areas. This left them vulnerable to direct fire and close combat techniques.
- The early T-34 suffered from one crucial weakness; the gunner was also the tank commander. This dual function interfered with efficient operation of the tank and rapid fire. In order to achieve maximum performance in one area the gunner/tank commander had to neglect the other. By the time the T-34 could fire one round the German *Panzer* could fire three. (The rate of fire of the German artillery weapons, at that time, was equivalent to that of the Russian tanks. This was an advantage for the German artillery.)
- At the very early stages of the Russian Campaign, the Soviets had equipped only their command tanks with two-way radios. All other tanks were without radios. This seriously hampered unit performance, particularly fire direction and control. In the event of destruction of the Russian command tank, they became leaderless. Platoons lost contact with each other and higher headquarters. The lack of unity of effort gave German artillery another opportunity to divide and conquer Russian tanks.
- The Russian tank optics were insufficient. The crews inside the tank were practically blind. They required a relatively long time to locate their targets.
- During the first two years of the campaign Russian tanks were used tactically in isolation from the infantry. The successful operations of combined arms were hardly known and it was relatively easy to destroy unsupported Russian tanks which had broken through [Ref. 338].

(4) Changes in Russian Armor Doctrine. The Russian doctrine improved drastically at the beginning of 1943. The revised Russian manuals stated that the attack represented the main kind of operation by which the decision on the battlefield would be gained. The goal became to break through the German front line forces and

destroy his rear combat zone. The attack was to be conducted in a rapid and resolute manner. The new doctrine led to the German forces being exposed to the new characteristics of the Russian attack during the heavy defensive battles from 1943 through 1945 [Ref. 339] (see Table 9):

-- Employment of massed Russian forces at selected points
-- Extremely heavy employment of artillery and mortars
-- Russian artillery continuing to fire on the German defensive lines as its own infantry penetrated those defenses, irrespectively of Russian casualties
-- Combined arms attacks with successive short range objectives being assigned one after another as each objective was met

Table 9

The Russian command had evaluated its experiences as they related to German doctrine and had successfully transferred the concept of combined arms operations to their own forces [Ref. 340].

(5) The Effect of Russian Production on German Command and Control.

From 1941 until the end of 1942, the Russian artillery was not capable of establishing fire superiority against the German mobile offensive operations. The reason for the limited effects of Russian artillery in mobile warfare lay in the lack of communications equipment and the lack of training for Russian crews at the time. The Soviet Army obviously underestimated the training required to use their artillery to its fullest extent. However, as soon as the German offensive operations were slowed and the Germans were forced into defensive operations, the Russian Army was successful in re-organizing its artillery. The last two years of the war the Russian artillery's fire direction and control improved remarkably [Ref. 341]. The Russian high rate of tank production, however, continued to be the dominant factor. The German Army was inferior to the Russian Army in numbers of men and weapons and had to fight against an improving Russian force from 1942 to 1945 (see Tables 10 - 12) [Ref. 342].

RUSSIAN ARTILLERY: Cannons per km front		
1942	Stalingrad	300
1944	Korsum	350
1945	Berlin	650

Table 10

RUSSIAN ARMOR: Per km front		
1942	Stalingrad	25-40
1943	Kursk	60
1945	Stettin	220

Table 11

GERMAN AND RUSSIAN TOTAL ARMOR PRODUCTION (1 January 1941 - End of the War)	
German Armor Production	25,000 Tanks
Russian Armor Production	150,000 Tanks

Table 12

After the catastrophe at Stalingrad there were only 1621 German *Panzers* and 100 Tiger tanks available on the entire Russian Front in May 1943. The following year the ratio of the German/Russian armor strength was never better than 1 to 7 [Ref. 343]. Russia was in a position to neglect its antiarmor defense to a certain extent; for the Germans it was quite different. The German armor had difficulty in defending against massed Russian armor attacks and the German infantry divisions had insufficient antiarmor capabilities. This required extraordinary measures for German command and control between infantry and artillery. Most of the attacks were repelled barely between 200 and 400 meters in front of the forward defensive positions. In the battles of World

War II, the attacker was forced to withdraw when one-third of his armor was immobilized or destroyed by fire [Ref. 344].

3. The Creation of German Assault Artillery

> Bring up the assault artillery...The life of a soldier of the assault artillery is short but eventful.
>
> A German Officer

When *Generaloberst* Ludwig Beck became Chief of Staff in 1933, the German Army possessed no motorized divisions. When he resigned in 1938, the army possessed five *Panzer* divisions, four light divisions, and four motorized infantry divisions. During his tenure he proved the feasibility of not only *Panzer* divisions, but *Panzer* corps. Beck and Manstein originally proposed the formation of assault artillery in 1935. Manstein drafted the plans for the yearly maneuvers and General Staff exercises. Beck encouraged the use of mechanized forces in these exercises. The infantry remained a problem. Beck planned to motorize the infantry divisions gradually as material became available. The General Staff in 1937 took the first step to motorize the infantry with the creation of assault artillery. They planned to issue each infantry division its own detachment of fully-tracked, armored fighting vehicles to provide the infantry with its own form of direct-fire artillery. These weapons also would serve an antitank unit, using the idea that the best weapon to fight a tank was another tank [Ref. 345].

4. Assault Artillery

> Fighting in an SP is the nearest thing that contemporary ground warfare can offer to the soldier's concept of a knight in armor.
>
> An SS Lieutenant

a. The Introduction of Assault Artillery

When infantry broke into enemy defenses it was then that they stood in greatest need of massive and well-directed artillery support. During World War I the communications systems lacked the flexibility required to switch the guns quickly onto fresh targets and to bring down concentrations of fire where required. German attempts to resolve the problems of this "artillery fire gap" included the use of horse-drawn or man-drawn infantry assault guns. The volunteer teams brought these towed pieces

forward with the infantry wave and thus gave the required close support to the attack. These were assault guns in the truest sense and for their daring the crew paid a price in heavy losses. These losses rose even higher when, after the introduction of tanks, they formed the first antitank gun teams [Ref. 346].

In 1935, Manstein, who at that time was serving in *OKH*, reconsidered the idea of assault artillery. He suggested that a tracked chassis form the gun platform and be powered by an internal combustion engine [Ref. 347]. Initially, the idea was met with debate both for and against this new concept. The main opposition came from the "*Panzer* idea" officers. They feared that the production of SP guns on tank chassis would reduce both the production and the numbers of tanks in service and, consequently, weaken their particular arm of service. Although a need for assault artillery was eventually conceded by all, neither the *Panzer* nor the artillery high commands were willing to devote any real effort to build up the new arm. Neither would accept it as part of their area of responsibility although it did eventually come under the control of the artillery gunners. As a direct result of procrastination, SP battalions, and later brigades, did not become part of every infantry division as had been intended. They were held in a sort of strategic reserve and designated as army troops [Ref. 348].

It cannot be claimed that the concept of assault artillery was a German one, nor that such vehicles were first used in the war between Germany and Russia. It was on the Eastern Front, however, that their potential was first fully realized and it was there that the assault artillery achieved the importance which kept them for decades as a main weapon in military armories [Ref. 349].

b. Assault Artillery Organization

The composition of an assault artillery brigade was an HQ with a troop of guns, varying in number between one and three, under direct control of the brigade commanding officer. The HQ battery also contained a supply squadron, a light workshop platoon and a recovery troop. The fighting component of each brigade was three batteries. Within each battery was a battle squadron, an ammunition squadron, a workshop group and a supply group. Each battle squadron retained one gun for the

commanding officer and disposed the others in two troops each of three guns and another troop of three howitzers. The organization of an assault artillery brigade was as shown in the following tables:

UNIT	QUANTITY & RANK
HQ staff and headquarters battery	143 - All Ranks including officers 8
Each fighting battery of 6 guns	101 - All Ranks including officers 3
The grenadier escort	198 - All Ranks including officers 2

Table 13

TYPE OF VEHICLES	QUANTITIES
Motorcycles or Tracked Vehicles	9
Light Trucks and Cars	23
Heavy Trucks	62
Half-tracked Vehicles	8
Trailers	18

Table 14

Each gun had a crew of four men: commander, driver, loader and gunner. The loader also operated the wireless. The standard uniform worn by assault gun crews was a double-breasted tunic, similar in cut to that of the tank crews but in field grey and not "*Panzer*" black. Red piping, indicating the artillery arm of service, was worn around the shoulder strap [Ref. 350].

c. Assault Artillery's Design and Capabilities

A variety of tracked vehicles was tried but it was the Pz Kw III and Pz Kw IV vehicles that the German assault artillery of the Second World War is most closely identified. To accommodate the initial 75mm L/24 gun, which was mounted on

the chassis, the entire turret had to be removed. This reduced the vehicle's total weight and lowered both its center of gravity and its silhouette, two considerable advantages [Ref. 351]. To protect the crew against shell splinters and small arms fire a roofed box of 20mm-thick armored shields was fitted on the top of the hull. Some guns later in the war were mounted within an open box shield [Ref. 352].

Preliminary trials carried out in 1937 demonstrated that SP crews could hit a target faster and more accurately than tank gunners. SP gunners, bracketing the target (i.e. placing one round over and one round short of the target; thereby determining the target range) unlike conventional gunners, could effect a killing shot within three rounds. *Panzer* gunners, on the other hand, shot towards their targets based on range estimation by the gunner. This method required more ammunition and more time to achieve the same result. Despite these satisfactory tests and the fact that SPs were cheaper to manufacture, their production still was delayed. Of the six batteries which had been activated by the time that the campaign against France opened during May 1940, only four saw active service there. The successes which those few guns achieved convinced even the most skeptical officers that here was a weapon of unusual versatility. Full-scale production was ordered, but to make up for the years of neglect was not easy. By the opening of "Operation Barbarossa", there were still only eleven batteries established. An immediate expansion was ordered when SPs demonstrated their great value and flexibility during the opening months of the campaign in the East [Ref. 353]. In addition to the standard SP gun, there were SPs in service which were in effect purely antitank (A/T) guns on an SP chassis. In the latter stages of the war it was not possible to distinguish between the SP and A/T roles, for both types of artillery were then used for the same purpose. In early 1944 it was possible to find assault artillery brigades, SP antitank battalions and tank-hunting battalions all carrying out the same tasks in the same fashion [Ref. 354].

Within twenty-four hours of opening "Operation Barbarossa" these weapons had proved their worth and had gained the confidence of the infantry of Army Group Center [Ref. 355]. By the end of May 1944, more than 20,000 kills had

been logged and this figure rose to 30,000 by the end of the war. The greatest number of victories were achieved on the Eastern Front against the T-34 and other Soviet tanks. So successful were the German SP gunners that it was a standing order to Russian tank crews to avoid a duel with an SP if at all possible [Ref. 356].

d. Assault Artillery: Its Concept of Employment

The following are instructions that were laid down in 1945 in "Leadership and Employment of Assault Artillery", an OKH document [Ref. 357]:

> Assault guns are armored artillery whose task it is to serve in the front line and to give close support to the infantry attack by beating down the enemy's weapons of fire. The platform is mounted on tracks, capable of cross-country performance and armed either with a gun or a howitzer. Through a combination of fire-power, mobility, armored protection and instant combat readiness, whether leading an advance guard or forming the point unit during a pursuit battle, assault guns are the decisive means by which a commander can control the changing circumstances of an engagement; enabling a point of maximum effort to be formed quickly, to support a weak flank or to add power to a counter attack.
>
> The basic organization is along the lines of field artillery and when used as front line artillery, SPs close the gap formerly existing by providing maximum support during those times of crisis which occur during an attack. In cases where field artillery is unable to support front line troops SP guns can be called upon, as a temporary measure, to carry out that role. Assault guns have a decisive effect when formed into a compact group and put in at the point of main thrust. This effect is reduced or lost completely if the unit is split up.

The assault gun brigades usually were allocated to infantry or to *Panzer-grenadier* (mechanized infantry) divisions and less frequently to *Panzer* divisions. Although a brigade was administered by the senior artillery commander, the regulations stated that an assault gun unit would come under the command and orders of the formation which it was to support--one generally not lower than a regiment. In fact, commanders of assault gun units often had more experience in SP/infantry collaboration than the infantry to which they were subordinate. It was not uncommon for a junior officer of the assault artillery to advise an infantry commander of higher rank on the tactics which should be used, on the lines of approach which he wished to follow and, in some cases, on the conduct of the battle. This says much for the flexibility of the

German command and control system that such advice was not merely accepted but often was sought by the infantry commanders [Ref. 358]

Emphasis was laid on the employment of the whole brigade as a single unit in a single mission. It was appreciated that terrain conditions or the tactical situation would not allow this always. Under such circumstances it was permissible to employ a battery of 6 guns, but finer sub-division of the battery into troops was to be avoided wherever possible. It was accepted that in street fighting or in forests a whole battery could not be deployed and single troops might have to be employed. As a general rule employment of single troops was forbidden, for experience showed how important it was to have a second vehicle on hand to overcome the difficulties of terrain or of mechanical failure. This last instruction could not be adhered to always in the latter stages of the war, for all too often there were only single guns to cover vast stretches of the front line. The initial establishment of independent batteries in 1940 eventually led to amalgamation into battalions, each made up of three batteries. There then followed an increase in the number of guns per battery from six to nine and, subsequently, to ten. These thirty-one gun battalions were eventually renamed brigades at the end of 1943, without, however, receiving any increase in strength. The brigade was the major tactical unit. Plans were made to raise the establishment of guns from thirty-one to forty-five but the deteriorating situation in the latter years of the war prevented this proposal being completely carried out [Ref. 359].

e. Tactical Employment of Assault Artillery

In tactical employment of assault artillery, the gun was used while the machine was halted. This usually happened while the infantry was bounding from one objective to another, according to the principles of fire and movement. Using direct fire, good results could be achieved at distances up to 2,000 meters but the most effective distances were inside 1,000 meters. The long 75mm gun used later in the war had a high muzzle velocity, a flat trajectory, good accuracy, good powers of penetration and fired several types of shells, the selection of which depended upon the target to be engaged. High explosive was recommended for use against field fortifications, heavy weapons and

observation posts. Tanks were fought with armor-piercing shot and the same type of ammunition was used to destroy pill-boxes. The 105mm howitzer, firing high explosive ammunition, was particularly effective against infantry targets, soft-skin vehicles and marching columns [Ref. 360].

When the enemy made an attack combining both armor and infantry, SP guns engaged the tanks while the howitzers bombarded the follow-up infantry in order to separate these from the armor and leave the armor unsupported [Ref. 361]. The tactics of the SPs were constant and rhythmic: advance, halt, fire, advance, halt, fire. The SPs had an advantage over tanks having lower silhouettes and firing halted and more stability. The guns had better sighting equipment than that on the Soviet tanks. The muzzle velocity of the early 75mm L/24 gun firing solid shot was 580 meters per second. This force was able to penetrate the lighter Russian machines used early in the war. The tanks then became engulfed in flames and blew up when the fires reached the ammunition lockers [Ref. 362].

One of the most important tasks in any operation was to defeat enemy armor. The early regulations stressed that assault guns were not to be used in a purely antitank role and emphasized that, unlike tanks, they were not suitable for collaborating closely with infantry or tanks. Events were to show the reverse to be true and that it became the SPs upon which the infantry relied, convinced as they were that as long as the assault artillery was in the line the situation was in hand. With the low production rates and the lack of the SPs on the front lines, by the end of the war the *Panzer* tank had to become the infantry gun [Ref. 363].

The greatest advantage possessed by SP units was the element of surprise or shock. To preserve this advantage, forward movement was made by night when possible. The noise of the SPs approach during this march into front line positions was concealed by the use of loudspeakers to amplify the sounds of tractors driving around on the front or even by the firing of an artillery barrage. Assault artillery usually took no part in pre-battle reconnaissance and was not intended for use in roles which could be carried out by the field artillery or by the heavy weapons sections of an infantry unit

[Ref. 364]. Adequate reconnaissance had to make certain the ground was passable, with neither swamps, heavily cratered areas, trenches or steep slopes to negotiate. Long night marches required an even closer cooperation with the infantry and also imposed a severe strain on the vehicle driver [Ref. 365]. This was especially true of driving in winter conditions. Where possible, winter night marches were avoided. More than fifty centimeters of snow reduced the vehicle's performance and increased the fuel consumption. Except when fighting a battle, the assault artillery was kept to roads free of ice and snow. It was even more important in winter that vehicles travelled in pairs. It was often towing by the second machine which enabled another machine ditched or trapped in snow-drifts to remain a "runner" [Ref. 366].

In the earliest days of the war the infantry unit supported by the gun moved on foot, but the practice was introduced of carrying infantry on the vehicle and towing the heavy weapons behind the SP. Eventually, this portering developed to the point where the infantry were "lifted" for long distances and thus brought very quickly into action [Ref. 367]. Regulations stressed the importance of the SP commander advising the infantry when his vehicles would have to withdraw for refuelling during a battle. To maintain infantry morale and to reassure them that they were not being abandoned, the SP commander had to be sure that not all his vehicles were withdrawn at the same time. If possible, more guns were left on the battle line than were being refueled or resupplied. Also to maintain morale, a permanent infantry detachment was allocated to a particular SP for local security [Ref. 368]. During an advance the guns could move ahead of the infantry, in effect blasting their way to the enemy position. In close country, or when driving through tall vegetation, the infantry moved ahead of the vehicles to protect them against enemy close-quarter attacks [Ref. 369]. Subordinate detachments of SPs, along with their attacked infantry, reverted back to battery control at the end of a mission and a battery returned to brigade until the next operation [Ref. 370].

In the final years of the war assault artillery was no longer able to be used in closely supporting the attacking infantry; the role changed to a tank killer. As Germany's military situation deteriorated, the task of the SP and the tank became interchangeable. Neither arm of service could initiate extensive operations but was put in wherever needed [Ref. 371].

B. GERMAN AIRPOWER AND ITS TACTICAL EMPLOYMENT

1. The Development of Airpower and Its Command and Control

As with balloons and dirigibles, the military possibilities of aircraft were apparent from the moment they were invented. During the Italian invasion of Libya in 1911 a handful of aircraft were used for bombardment, artillery liaison, and reconnaissance, including even crude attempts at aerial photography. During that campaign, it was conclusively demonstrated that success depended as much on training, doctrine, and organization as on the flying machines themselves. Italy was too poor a country and had too small a technical and industrial base to lead in aviation. Primacy passed to the Germans. At the outbreak of World War I, the Germans possessed not only the world's best equipped fleet of dirigibles but also the largest number of military aircraft. Like the dirigibles, the airplanes were integrated fully into the military organization down to corps level. Also like the balloons it was intended that their primary use would be in liaison and reconnaissance [Ref. 372].

Reconnaissance and the functions related to it--liaison and artillery observation--was very important during the four years of World War I, but the airplane was soon eclipsed by its own tactical employment. With the technical advances came increasingly sophisticated tactics, and here again the Germans pioneered. Numerous experiments were made in developing techniques for mutual support and formation-flying. Here progress was difficult to achieve because the wireless of the day was too heavy and too cumbersome in operation to be carried by most aircraft [Ref. 373] thereby limiting command and control of airpower as a supporting arm.

During the interwar years aviation technology in general, and military aviation technology in particular, advanced by leaps and bounds [Ref. 374]. Military aircraft not only became faster but more capable. Most aircraft were now equipped with two-way radio sets that enabled them to communicate with their base and also with each other. The Germans, followed by others, also pioneered in using direct radio communications between aircraft and land units, down to division level--a vital step if effective air-ground cooperation was to be achieved. As in the case of armor, there is a tendency to overlook the role played by communications in favor of more spectacular characteristics of performance. However, communications did as much as any other factor to explain the changes that took place in conduct of air warfare from the First World War to the Second [Ref. 375].

The German *Luftwaffe* originally was designed for forward interdiction and close air support [Ref. 376] (due in large part to Hitler's fixation with dive bombers). This potential for aircraft carrying out tactical and operational missions was first demonstrated by the *Luftwaffe*. Since many of its commanders were ex-army officers, the *Luftwaffe* developed air-to-ground cooperation into a fine art [Ref. 377].

2. LtCol Alfred Baentsch's Assessment of Airpower

An able representation of the General Staff's appraisal of mechanization and airpower appeared in 1938 in an article by LtCol Alfred Baentsch, of the General Staff's history office. Baentsch never achieved greatness or fame; he was one of those staff officers who all but anonymously pursued his duty and calling in life. Nonetheless, his thoughts on the future of warfare oddly foreshadowed the actual form of combat that soon followed in 1939. Baentsch observed that one could not consider air and ground warfare separately. The task of a modern supreme headquarters was to unite the two in a coherent plan. The Spanish Civil War demonstrated to both France and Germany that massive bombing of an enemy's cities would not lead quickly to victory. The advent of antiaircraft guns, advanced communication methods, and fighter planes armed with automatic cannon indicated that any such bomber offensive could be a long and costly

proposition. Baentsch maintained the first aim of the air force should be the subjugation of the enemy air force through attacks upon his air fields either to destroy the aircraft or suppress their operations. Once air superiority was secured, the air force could be used to bomb production centers, tactically assist the army or navy, or hinder the enemy's movements. Above all, all three armed services must unify their operations towards one goal [Ref. 378].

3. German Offensive Airpower

Pre-World War II German Army thinkers generally observed the strategic bombing of a foreign country as an untried and expensive proposition. It was far more judicious to channel one's air power into directions with a successful history such as reconnaissance, tactical support of ground troops, and interdiction of supply lines [Ref. 379]. Another factor that figured into the use of German airpower as airmobile artillery had to do with problems experienced with artillery and mud during the First World War. The German Army's heavy guns had been taken over and destroyed by the Allied disarmament commissions after the war. When the German Army rearmed, heavy and super-heavy artillery was high on the list of priorities. During the interwar years, this was a cause of a great deal of contention because there were those who recalled with no delight the difficulties of moving enormous artillery weapons piecemeal through the mud of Flanders [Ref. 380].

With the rise of airpower, and the gradual increase in speed, bomb load and endurance of aircraft, it often was asked if heavy artillery was worth manufacturing and what, if any, was the advantage it had over aircraft. Although the Germans accepted the idea of tactical air support, developing the well-known Junkers 87 *Sturzkampfflugzeug* ("*Stuka*") dive-bombers, they also decided to build conventional artillery for all-weather support because the aeroplane at the time could not guarantee being available to fly bombing missions around-the-clock and in all weather [Ref. 381].

In 1923, on the flatlands of Pommerania, General Erich von Tschischwitz had assumed command of the 2nd Infantry Division. He directed Major Walther von Brauchitsch, who later served as Commander-in-Chief of the Army, to conduct exercises

testing the combined operations of simulated motorized units and aircraft. The operation proved a success [Ref. 382].

4. German Airpower In Tactical Support

Dive bombing by the German air force became the battering ram of the German Army's fast attack during the Second World War. Dive bombing employed in close coordination with tanks, motorized infantry, and other ground forces helped bring battle to a swift conclusion. Aviation gave the battlefield a third dimension: height, giving new meaning to space (and time) when dealing with force at the operational level of war. The mobility of airpower enhanced the attacker's ability to seize the initiative and dominate the battlefield from above. Forces no longer fought for surfaces, limited to length and breadth; the modern battlefield now spanned all dimensions in a manner never before envisioned by military planners. [Ref. 383]

German air force units participated in the Spanish War along with German ground forces and essentially used that War as a proving ground for their new offensive doctrine. German military experts were anxious to employ their air force tactically in land warfare and gain practical experience. They succeeded in Poland and Belgium by using tactics that surprised not only the ground forces but the opposing air forces as well. Those who ignored the German *Wehrmacht's* Spanish experiences later paid for their neglect in not recognizing the potential of the combat power of air as well as mechanized forces. [Ref. 384]

One of the valuable experiences gained by the Germans was the use of bombers in combat. The experience gained helped the German *Luftwaffe* in the technical development of dive-bombing. Exercises carried out in Spain later led to further development of the *Stukas*. The problem to which the Germans gave most of their attention was hitting targets from the air with a precision approaching that of artillery. There was a need to find a new weapon capable of effectively supporting a rapidly moving mechanized force in a timely manner and the dive bomber was developed to supplement and sometimes replace artillery. [Ref. 385]

Immediately after the conclusion of the Spanish War, articles appeared in the French military press correctly explaining the significance of dive-bombing aircraft used as air mobile artillery. Official military circles in France rejected the idea that this was a significant development in the use of airpower. The French generals believed the Spanish experience was exceptional because the opposing forces were deficient in artillery. They refused to recognize airpower as a vital source of fire support for ground forces. [Ref. 386]

5. The New German Air Arm

Airpower was perceived by the German Army to have a wide influence over battle on the ground. The German airpower was divided into the following headings: reconnaissance, protection, liaison, supply and support. Air reconnaissance would give not only the enemy's disposition but also that of friendly forces. Air reconnaissance was to be made in coordination with ground reconnaissance. Modern battles produced complicated situations where isolated groups fought over wide areas, and air reconnaissance was necessary to give rapid information essential for the use of combat power. [Ref. 387]

Reconnaissance, protection, and liaison were considered complementary functions. Aviation gave protection in several forms. The fighters were to win air mastery immediately above the battle. There also was to be a screen of fighters in the opponent's rear. These two fighter groups, the screen at a distance and the "umbrella" overhead, prevented the enemy not only from bombing the troops on the ground but also from observing them, either at an angle from a distance or more clearly from directly overhead. Air reconnaissance had a protective value through warning of impending danger, while bombers acted to protect when they bombed enemy forces and the roads they were using and hindered the enemy's approach to the battlefield. The air arm was to protect the flanks of the ground units during the breakthrough by bombing and reconnaissance. Additionally, it was the air arm, through its speed, that would link and give cohesion to separate and isolated ground actions. [Ref. 388]

German airpower mainly affected the land battle through the use of dive bombers as air mobile artillery. The advantages gained by using bombers to replace part of artillery fire follow:

- The "gun positions" of a bomber force were aerodromes far to the rear, sometimes 250 miles away. This enabled the attacker to go about preparations unobserved. The scattered distribution of airfields prevented the defender from ascertaining the point of origin of a raid beforehand. The mobility of air forces and modern communication permitted the attacker to concentrate his airpower with lightning rapidity on the air thrust-points chosen.
- The great offensives of the First World War required massive artillery fire. The long columns of guns choked the roads by moving up towards the action. The artillery had to be fed with tons of ammunition: once the artillery had moved up and the battle had begun, the roads were congested with munitions trains. Airpower, however, did not require the direct use of roads.
- An offensive of World War I status required an artillery preparation that took a long time and betrayed the plans for an offensive. Air forces gave away no secrets.
- The chief advantage of the airpower was neutralizing or suppressing not only the front line forces of the enemy's defense, but also attacking the enemy forces in depth, thus crippling defensive activity. Airpower was to silence the enemy artillery and render reinforcement impossible. It isolated the battlefield from the enemy's reinforcements held in rear areas.

6. The German Air Order of Battle

In the initial development of German airpower, the German command and control system put a great deal of emphasis on defining the German air order of battle. The Germans worked out a complete organization for these planes so that the air units attached to the land forces could be used with maximum efficiency in a break-through (or *Blitz*) attack, as follows:

- Long-range combat: these fighter units were to gain mastery of the air over the battlefield, and maintain this mastery throughout the whole battle. They patrolled as far as twenty to forty miles into enemy territory, at various heights, giving long-range protection to the bombing units. As most modern fighters could carry bombs, they also carried out such incidental tasks as the bombings of convoys, roads, bridges, etc.
- Long-range reconnaissance: these units were to give the information necessary for operational decisions regarding the movements of large units, using aerial

photography. They were to watch for the approach of enemy forces from the rear and other enemy activity.

- Tactical reconnaissance: dealing mainly with the details of action, and working usually from a height of 5,000 to 9,000 feet, these units outlined the situation of both sides before combat, watched the development of the combat, and watched particularly for the firing positions of the opponent, also checking on and spotting for their own artillery.

- Combat reconnaissance: these units were to watch first for the enemy's planes, and were to carry out reconnaissance for friendly bombers. Machines of these units in some cases lead their bombers to the desired targets. Communication between the three types of reconnaissance planes and the different signal centers of the units taking part in the attack was maintained by means of flares, recognition signals, and wireless. As a large proportion of these reconnaissance planes carried bombs, they were able to take some part in the combat on the ground. Usually their participation in fighting on the ground was dictated by their own observation: they bombed where they spotted.

- Counterbattery and distant support: this category of attacking aircraft consisted of bombers. During the approach march of the tanks and other attacking units, these bombers were to be used first against the enemy's long-range artillery positions, then against his divisional artillery. They were then to direct their attack against the enemy's chief zones of resistance; their bombs thus replaced the artillery preparation that in the First World War was the chief task of artillery. Finally they were to concentrate upon zones immediately behind the enemy's main positions, to isolate those positions from the rear. During mass attacks by tanks it was the vital duty of the air arm to keep the enemy's artillery out of action by bombing the gun positions.

- Close support: this section was to give direct support to the ground combat teams (*Angriffsgruppen*) and accompany them throughout the action. They were to bomb the targets that were the immediate objectives of their ground units. They accomplished this by dive bombing and low-level bombing, machine gun and cannon fire. As the attacking force made contact with the defense positions, it was their job to reduce the barrage put up in front of the main defense zone. Later they transferred their activities to points deeper within the enemy lines, keeping pace with the progress of their attacking units on the ground.

- Reserves: A certain number of first-line air force units of various types were to be kept in reserve for unforeseen eventualities. They could be used to switch the "air thrust point" to a new area and attack strong points which suddenly could check the advance. The reserves were divided into three sections:
  (a) One section was over the battlefield ready to intervene at any moment if it became necessary.

(b) The second section stood by, ready to take off whenever necessary, and to relieve the first echelon every two hours or so.
(c) The third section of the reserve consisted of fighters, whose function was to strengthen the long-range combat units if the defense made a substantial attempt to recover mastery of the air over the battlefield. This section was also on standby [Ref. 389].

As with artillery support, close cooperation was the basic key for success between air and ground forces, but it was also the hardest part. The wide difference in the speed of the ground and air forces caused some of the difficulty; another problem arose from the unpredictable development of each situation. The coordination of land and air movement had to be worked out in advance through a liaison detachment from the German Air Force. [Ref. 390]

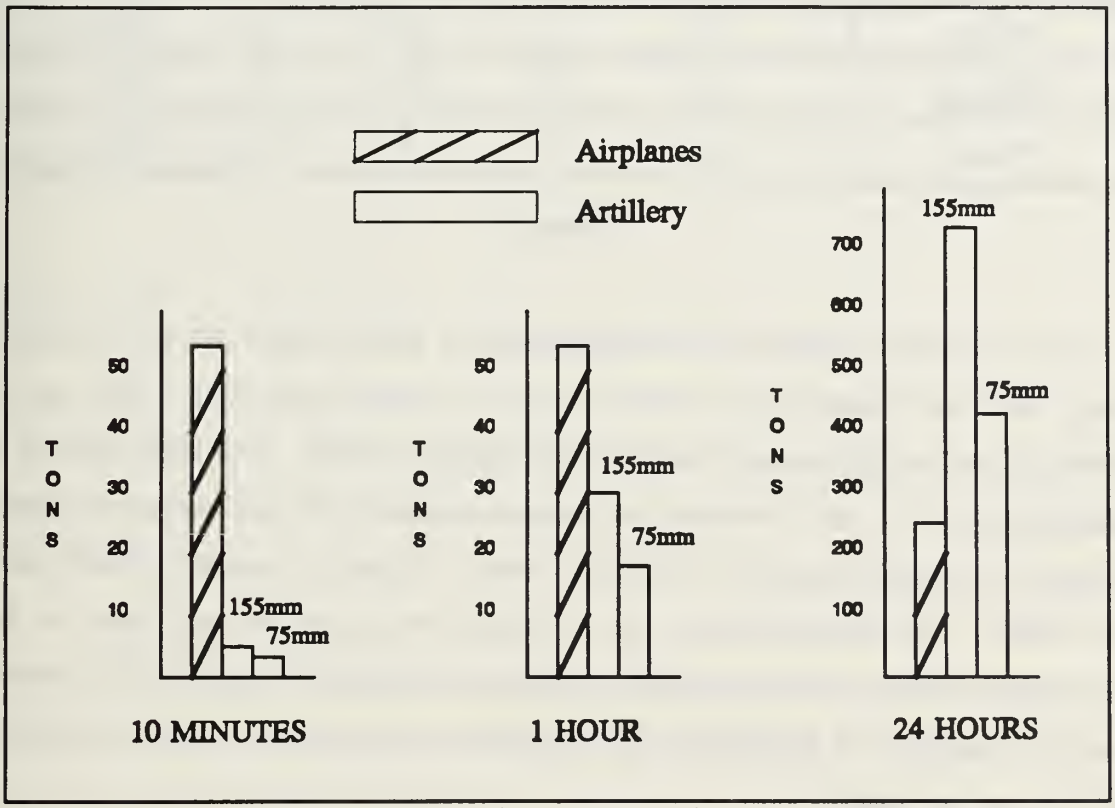

Figure 5 Comparison of Air and Artillery Bombardment

The value of air power to mobile warfare lies in its versatility, responsiveness and ability to deliver a massive amount of ordnance in a relatively short period of time. Towed artillery cannot fully support a mechanized attack due to the lack of mobility when

compared to mechanized forces with tracked vehicles. The *Luftwaffe* acted as a counter balance to the slower supporting arm. The initial responsiveness and delivery of ordnance favored airpower, which is able to react almost immediately when required by a developing situation. Figure 5 visually displays the amount of ordnance delivered by both dive bombers and artillery during the specified time periods. The units compared are 12 guns of each stated caliber and a group of 3 squadrons of medium bombers (27 planes). Table 15 shows the throw weights of air and artillery bombardments for the time displayed in Figure 5. [Ref. 391]

Comparison of Air and Artillery Bombardment in tons			
Planes	54	54	250
155mm	5	30	720
75mm	3	18	432

Table 15

In protracted combat the advantage shifted to artillery since the guns continued firing while the planes had to return to base to rearm [Ref. 392]. This was an advantage artillery possessed in defensive or attrition warfare. The theme behind the *Blitzkrieg*, however, was movement and speed enhanced by the responsiveness of arms. Artillery's weakness became conspicuous when displacing forward towards battle [Ref. 393]. The howitzers were out of action until emplaced and ready to fire. Airpower's strength lies in its ability to provide an airmobile platform that responds quickly throughout the battlefield. This capability made airpower the ideal weapon for the German fast attack.

The *Blitzkrieg* owed much of its effectiveness to the Germans' revolutionary handling of tactical air support [Ref. 394]. The German command and control placed a great deal of emphasis on developing its new air arm. Aircraft lent flexible speed to supporting arms in the attack. Time for the German *Wehrmacht* was paramount

and airpower proved to be a dynamic force. The Germans did not have the manpower or resources for protracted warfare. The dive bombing the German Army employed so successfully aided in bringing campaigns to a swift conclusion. The air-ground tactics matured with combat, as with any new system. While never surpassing artillery, airpower complemented it. Airpower added another dimension to the combined arms attack, establishing its versatility. In the Second World War, the airpower began to emerge and shape the modern air order of battle, due in part to German airpower being used almost exclusively as an adjunct to land power [Ref. 395].

Infantry guns, assault artillery, antitank guns and *Stuka* dive bombers all combined to prove the worth of the German command and control system during the initial phase of the Second World War. Hitler's strategic delay in the attack through Moscow, however, proved to be the decisive factor on the Eastern Front. That the *Wehrmarcht* engaged in the long campaign that it did is a credit to its doctrine, training and tactical expertise.

VI. GERMAN DOCTRINE/COMMAND AND CONTROL AND THE ELASTIC DEFENSE

Before World War II, the German Army concentrated on its new-found offensive combat power to the exclusion of all else. This doctrine and German command and control initially produced staggering combat power. Hitler's misdirection of the German Army into the Ukraine in August 1941 diffused the blows of the German Army that so recently had brought western Europe to its knees and gave the Soviets the opportunity to recover. In the lengthy defensive phase of the war the German Army was effective against the larger and better equipped Russian forces, but the German Army's resources were drained. The Germans were no longer able to sustain the offensive nature of the *Blitzkrieg*. To conserve combat power, Germany assumed the stronger form of war: the defense. The German defensive doctrine at the beginning of the Second World War was still mired in the "Elastic Defense" developed at the end of the First World War. The *Wehrmacht* placed so much "trust" in mobile or *Blitzkrieg*-type warfare that this overshadowed any thought of defensive doctrine. In the words of a senior German Officer:

> It is surprising indeed how often and to what extent veteran officers, who had already participated in World War I, had forgotten their experiences of those days. The fact that [German] peacetime training shunned everything connected with defensive operations under difficult winter conditions proved now detrimental for the first time [Ref. 396].

A. GERMAN DEFENSIVE DOCTRINE LEADING UP TO WW II

1. The First Years of World War I

Through the first two years of the First World War, German and Allied doctrinal practice had been to defend every meter of front by concentrating infantry in forward trenches. This prevented any enemy incursion into the German defensive zone but inevitably resulted in heavy losses to defending troops due to Allied artillery fire [Ref. 397]. Technology in the form of the machine gun and quick fire artillery,

coupled with the lack of a effective interpretation of conflicts before World War I, led to trench warfare and unimaginative tactics. Artillery fire was administered in increasingly massive doses by the Allies, who regarded artillery as essential for any successful advance. Consequently, the Germans sought a defensive deployment that would immunize the bulk of their defending forces from the annihilating cannonade [Ref. 398].

2. The "Elastic Defense"

Between September 1916 and April 1917, the Germans condensed their tactical lessons into a novel defensive doctrine, the "Elastic Defense". This doctrine focused on defeating enemy attacks with a minimal loss to defending forces rather than on retaining terrain for the sake of prestige. The "Elastic Defense" was meant to exhaust Allied offensive energies through a system of fortified trenches arrayed in depth. By fighting the defensive battle within, as well as forward of, the German defensive zone, the Germans could exploit the inherent limitations and vulnerabilities of the attacker while conserving German forces [Ref. 399]. The main defensive line would be some distance to the rear of a forward security line. Although still within range of Allied guns, the main defensive positions would be masked from direct observation. Fired blindly, most of the Allied preparatory fires would be wasted [Ref. 400].

In developing the "Elastic Defense", the Germans analyzed the lessons of trench warfare. The German Army realized that concentrated firepower, rather than a concentration of personnel, was the most effective means of dealing with waves of Allied infantry. The Germans had also learned that the ability of attacking forces to sustain their offensive vigor was limited. Casualties, fatigue, and confusion debilitated assaulting infantry, causing the combat power of the attacker steadily to wane as his advance proceeded. This erosion of offensive strength was so certain and predictable that penetrating forces were vulnerable to counterattack, if defensive reserves were available. The Allied artillery, which was devastating when laying prepared fires on observed targets, was far less effective in providing continuous support for advancing infantry. The difficulty lay in coordinating such fires in the days before portable wireless

communications. The ravaged terrain hindered the timely forward displacement of guns and any successful attack forfeited its fire support once it advanced [Ref. 401]. This lack of offensive support lead to the development of the infantry gun and, later, assault artillery.

The Germans modified and refined their "Elastic Defense". Among other changes, the battle zone was deepened, heavy machine guns were removed from the static redoubts (a defended position or protective barrier) to provide suppressive fire for the local counterattacks, and German artillery was encouraged to displace rapidly to evade counterfire. The new defensive techniques worked well in 1917 on the Western Front. In April, the massive French Nivelle offensive was stopped cold, with relatively few German losses. The British also tested the German defenses with attacks in Flanders at Arras and Passchendaele. Although the British enjoyed some local successes, no serious rupture of the German defensive system occurred. The novel system of "Elastic Defense" was validated [Ref. 402].

3. The "Elastic Defense" and the British Tank

One ominous development that seemed to challenge the continued effectiveness of the "Elastic Defense" was the British tank attack at Cambrai in November 1917. There, massed British tanks broke through the entire German defensive system. The combined effects of German counterattacks and British irresolution restored the German lines but the wholesale use of tanks to sustain the forward advance of an attack seemingly upset the logic on which the German defensive concept was based [Ref. 403].

The Germans minimized the British success at Cambrai by stating that it was the result of tactical surprise. They did not see the newly-developing mobility of the tanks as the offender. The German Army reasoned that tactical surprise was achieved without the customary ponderous artillery preparation (not having been given warning), rather than from the tank attack itself. In consequence, no reassessment of the "Elastic Defense" was deemed necessary, and none was undertaken before the Second World War. The updated version of the German doctrinal manual for defensive operations published in 1918 made no special reference to tank defense [Ref. 404]. Additionally, isolated examples

of German defensive successes right up until the armistice seemed to indicate the "Elastic Defense" would have prevailed had the troops not lost their élan and continued to practiced the defense correctly [Ref. 405].

4. The Interwar Years

The "Elastic Defense" was the obvious theoretical starting point for interwar doctrinal development. It remained the essence of German defensive practice until the beginning of World War II. The German postwar years were filled with debate of positional versus the maneuver visions of future wars. To some German officers, the "Elastic Defense" seemed too trench oriented, and they argued that the retention of a doctrine designed for positional warfare would invite disaster in future wars. At the very least, the "Elastic Defense" needed to have its antitank properties upgraded to confirm its continuing validity in an armored warfare environment [Ref. 406].

General Ludwig Beck, Chief of Staff of the German Army from 1933 to 1938, held profoundly orthodox views (i.e., conforming to established doctrine). Even so, evidence shows that Beck had an understanding of the need for mechanized forces. While he saw the need for mechanized warfare, he may not have appreciated fully the implications. The offensive and defensive phases of war are intertwined and the German Army did not mechanize its infantry adequately before the Second World War. This lack was a weakness on which the Russian Army later would capitalize to gain a foothold in Western Europe.

Beck planned gradually to motorize the infantry divisions as material became available. This never was achieved to the extent needed (a common problem in all Western Armies). Had the *Wehrmacht* succeeded in so doing, it might have expanded its defensive doctrine. While the "Elastic Defense" of World War I proved ineffective in World War II, there are a few examples of it being used successfully.

B. THE EARLY TRIALS OF THE SECOND WORLD WAR

From the beginning of the Second World War, the German infantry was organized as an army of attack, with quality stressed over numbers. The infantry never was cast in a purely defensive role and professional military inquisitiveness and candor were widely encouraged [Ref. 407]. This institutionalized trait of self-evaluation to improve combat effectiveness did not, however, serve the Germans as well in their preparation for war with the Soviets. The campaign in Poland and France provoked no changes to German defensive doctrine. If anything, operations during these spectacularly successful German offensives seemed to diminish the importance of defensive precautions. Skewered by German thrusts, the Polish and French Armies succumbed without seriously testing German defensive measures in return. Although in each campaign the Germans learned some valuable tactical lessons, they were insufficient to spur a reevaluation of German defensive techniques [Ref. 408].

1. Lessons Learned in Poland

In October 1939, in an Army High Command memorandum detailing deficiencies uncovered in Poland, defensive operations were listed as an area in need of immediate improvement. After-action reports revealed a general dissatisfaction with training and small-unit leadership, Still, this complaint emphasized performance rather than doctrine [Ref. 409].

2. Lessons Learned in France

The campaign in France was not totally without defensive lessons. Most disquieting was the British tank attack at Arras on 21 May 1940. There the rapidly advancing German *Panzers* had become separated from their accompanying infantry. Falling on the unsupported German infantry forces, the British armored attack illustrated not only the danger inherent in the German policy of giving separate offensive and defensive roles to their tanks and infantry, but also the inadequacy of German antitank weaponry. Only the timely fire of German 88mm *Flak* guns and 105mm field guns prevented the German infantry from being overrun entirely, as shells from the German 37mm *Paks* and the even lighter antitank rifles rattled off the British *Matildas* without apparent effect. German

tanks, hurriedly returning to the aid of the infantry, were not effective against the heavily armored British tanks [Ref. 410].

This close call at Arras caused some ripples of concern within the German Army; yet, this concern did not mature into reform. Although the German *Panzer* and infantry forces had become perilously divided during the advance to the channel--a situation to be repeated on an even grander scale in Russia--neither the French not the British had been able to exploit decisively this vulnerability. The Germans shrugged off the potential danger and simply activated a few new motorized infantry divisions in the year between the fall of France and the invasion of Russia. This was not nearly enough to provide defensive security for the *Panzers* or to take up the slack between the mobile units and the trudging infantry forces. The Germans merely reaffirmed the exclusively offensive role of their *Panzer* divisions: a new *Panzer* operations manual published in December 1940 devoted twenty-six pages to discussing attack techniques, but only two paragraphs discussed defense [Ref. 411].

3. The "Elastic Defense" in Western Europe

The German command and control was forced late in the war to counter the effects of intense artillery preparatory fires. General Hermann Balck used a variation of the "Elastic Defense" in Lorraine against the U.S. Third Army late in 1944. The battles in the Huertgen Forest, in which the U.S. First Army attempted to break through the German defenses, showed how effective the "Elastic Defense" could be in the right terrain. Four U.S. divisions were mauled severely attempting to penetrate the German lines. Though the Germans were aided by the poor weather conditions during the fall season, which prevented effective use of American air power, the German "Elastic Defense" proved sufficient for the situation at the time [Ref. 412].

C. ANTITANK DEFENSE

1. German Antitank Defense

While serious reform of defensive doctrine did not occur before the Second World War, some German officers gave serious consideration to antitank defense methods

because the Allies had used tanks impressively in 1918. Rooted in their memories of the 1918 collapse was the nagging fear that--as Ludendorff finally had conceded--tanks had become the single most effective tool for prying open the "Elastic Defense" [Ref. 413].

Beck's orthodox views on doctrine had institutionalized the "Elastic Defense" in *Truppenführung*. He recalled the emphatic pronouncements of German officers in 1918 that tanks were merely nuisances to a properly organized "Elastic Defense" in depth. Beck saw the traditional combat arms--infantry, artillery (artillery was considered a combat arm by the Germans Army as opposed to combat support today), and even cavalry--as being decisive. He resisted the notion that armored formations could become equal to these or have a pivotal impact on the battlefield. Given such a misconception, Beck deemed antitank defense measures as secondary to the central problem of halting artillery-supported attacks by enemy infantry.

Beck was at odds with Guderian because he was not in complete support of Guderian's mobile warfare ideas [Ref. 414]. Nevertheless, it was Beck and Manstein who originally proposed the formation of assault artillery in 1935. When Manstein had drafted the plans for the yearly maneuvers and General Staff exercises, Beck encouraged the use of mechanized forces in these exercises. In 1933, when Beck became Chief of Staff, the army possessed no motorized divisions. When he resigned in 1938, the army possessed five *Panzer* divisions, four light divisions, and four motorized infantry divisions. During his tenure he proved the feasibility of not only *Panzer* divisions, but *Panzer* corps [Ref. 415]. This seeming contradiction implies Beck either understood or later had reconsidered mechanized warfare's inherent advantage.

2. *Panzerabwehrkanonen*

Tanks had to be neutralized by a combination of obstacles, minefields, and antitank weapons. Although antitank rifles would be available in all parts of the German defensive zones, the crew-served antitank guns (*Panzerabwehrkanonen* or *Paks*) and direct-fire artillery would generally be located to the rear of the main line of resistance

[Ref. 416]. Although *Pak* sections could be attached to forward elements in certain circumstances, the Germans thought these guns could be used more effectively as a "backstop" for the main infantry trench systems. They reasoned that these rearward antitank weapons would be relatively safe from any preliminary artillery bombardment, would be free to mass opposite of the tank penetrations as necessary, and could engage those tanks without interference from enemy infantry. German doctrine also allowed for the creation of special antitank assault groups composed of small teams of infantrymen who would destroy enemy tanks with mines and explosive charges from close range. All German units were expected to counterattack vigorously to regain any position, even if it had been temporarily overrun by hostile tanks [Ref. 417].

Through the 1930s, German antitank doctrine corresponded to the techniques first hammered out in 1917. The first task of the defending forces was to halt the enemy infantry. That done, the isolated enemy tanks would then be at the mercy of German antitank weapons and close assault. Most German writings about antitank warfare in the interwar period were based on the assumption that tanks without infantry were completely vulnerable to antitank weapons. A German officer spoke for many when he asserted that experiences in the Spanish Civil War confirmed that "the defense is superior" to tanks since every tank-antitank duel in Spain had allegedly ended with victory for the antitank gunners [Ref. 418].

After France, it was clear that the immediate problem was the woeful German antitank weaponry. Hitler ordered the punchless *Panzer* III upgunned. This was completed the next year. The German *Paks* could not be replaced or repaired so easily, still some captured French 47mm guns and a few new 50mm *Paks* were introduced to augment the German antitank weapons. The nearly ineffective 37mm antitank guns, the smaller weapons, remained the primary dedicated crew-served antitank weapons at the beginning of Barbarossa. As an interim precautionary measure, German field artillery units placed greater emphasis on training gunners for close-range antitank engagements during the spring of 1941 [Ref. 419].

3. The Antitank Defense and the German Tank

One remarkable omission from the list of German antitank weapons was the tank itself. General Ludwig Ritter von Eimmansberger spoke for most German officers when he wrote in 1934 that "the principle claiming the tank to be the best antitank weapon has already been outlived and rendered untrue". Like other facets of German doctrine, this belief stemmed from remembrances of the Great War, in which German tanks had played no antitank role. The German Army had become convinced that tanks were "expressly weapons of attack". This opinion was elevated to dogma in interwar German manuals and was frequently reiterated by Guderian and other German tank enthusiasts [Ref. 420].

Although *Panzers* were not considered antitank weapons themselves, the Germans did develop a doctrinal role for their armored forces that exploited the tank's offensive nature and conformed neatly to the "Elastic Defense" format. In defensive battles, *Panzer* units were to be held in reserve for delivering the counterattacks vital to the "Elastic Defense" in depth. The shock and mobility of the *Panzers* would lend weight to German counterblows, thus assuring the annihilation of enemy infantry or armor mired in the German defensive zones [Ref. 421]. Some German officers saw in this system a clear-cut division of labor between tanks and infantry. *Panzer* units would be used exclusively in offensive roles, even within defensive scenarios. Infantry forces, presumably unable to keep up with the offensive battles of maneuver envisioned by the *Panzer* generals, would be indispensable for defensive purposes due to their ability to occupy and hold terrain. That *Panzer* forces might have to conduct defensive operations unrelieved by German infantry divisions was almost totally discounted [Ref. 422].

D. GERMAN DOCTRINE ON THE EVE OF BARBAROSSA

Before the beginning of Operation Barbarossa in 1941, the German Army adhered to the defensive doctrine originally developed to address battlefield conditions of World War I. That doctrine concentrated on halting enemy infantry attacks by means of a

defense-in-depth consisting of a series of defensive zones. Within these zones, enemy infantry forces were to be defeated by firepower, tactical maneuver, and vigorous counterattack. In the 1918 tradition, tanks were regarded as a lesser threat than enemy infantry. German antitank measures followed the 1918 outlines: enemy tanks would have their accompanying infantry stripped away; their advance would be obstructed by mines and obstacles; and, a mixture of direct-fire artillery, antitank gunfire, and individual close assault would destroy those tanks that actually penetrated the German defensive positions. German tank units lacked a defensive role other than to deliver counterattacks necessary to crush penetrations [Ref. 423].

Whatever its potential faults, this doctrine suited the structure of the 1941 German armies. Its few *Panzer* units aside, the *Wehrmacht* was as over-whelmingly pedestrian as had been the Imperial German Army of 1918. The "Elastic Defense" fit the skills, capabilities, and disposition of this preponderantly infantry-based force.

The German "Elastic Defense" doctrine made the following assumptions about modern warfare, and those assumptions would be tested severely and found wanting in the campaign against Russia [Ref. 424]:

- The burden of any sustained defensive fighting would be borne by infantry divisions, supported only as necessary by *Panzers* held in reserve for counterattack.
- Sufficient quantities of German infantrymen would be available in defensive situations to organize a cohesive defense in depth.
- The principal threat would be posed by the enemy's infantry forces, and therefore, any German defense should be disposed primarily to defeating a dismounted attack.
- German commanders in defensive operations would be allowed the flexibility to select positions and conduct the defense in an "elastic" fashion as had been the practice in 1918.

None of these assumptions had been disproved in the 1939 or 1940 campaigns. However, within the first two years of the Russian campaign, the German Army conducted major defensive operations under circumstances that invalidated them all [Ref. 425] and which had repercussions on German command and control and the employment of supporting arms.

E. OPERATION BARBAROSSA AND THE "ELASTIC DEFENSE"

1. The Defensive Aspect of the *Blitzkrieg*

In the Russian campaign's opening battles, the Germans used *Keil und Kessel* (wedge and caldron) tactics to effect the encirclement and destruction of the Red Army in western Russia. After penetrating Soviet defenses, rapidly advancing German forces--their *Keil* spearheads formed by four independent *Panzer* groups--would enclose the enemy within two concentric rings. The first ring would be closed by the leading *Panzer* forces and would isolate the enemy. Following closely on the heels of the motorized elements, hard-marching infantry divisions would form a second inner ring around the trapped Soviet units. Facing inward, these German infantry forces would seal in the struggling Russians, containing any attempted breakouts until the caldron, or pocket, could be liquidated. The mobile forces in the wider ring faced outward, simultaneously parrying any enemy relief attacks while preparing for a new offensive lunge once the pocket's annihilation was complete [Ref. 426].

Generally, in offensive maneuvers, the Germans sought to place their units in a position from which they could conduct tactical defensive operations. In this way, the Germans could enjoy both the advantage of strategic or operational initiative and the benefits of tactical defense. True to this principle, the encirclement operations conducted during Barbarossa contained major defensive components. Once a *Kessel* was formed, the temporary mission of both the *Panzer* and the infantry rings was defensive: the inner (infantry) ring blocked enemy escape, while the outer (armored) one barred enemy rescue. The defensive fighting that attended the formation and liquidation of these pockets revealed serious problems in applying German defensive doctrine [Ref. 427].

Fearsome in the attack, German *Panzer* divisions were ill-suited for static defensive missions due to their relative lack of infantry. During deep encirclements, *Panzer* divisions found even their own defense to be a problem. Pre-war German defensive doctrine had envisioned using infantry for defensive combat and reserving *Panzer* units for counterattacks, a role commensurate with their supposedly offensive nature [Ref. 428]. *Panzer* divisions were neither trained not organized to fight

defensively without infantry support. The German *Panzers* routinely ranged far ahead of the marching infantry and were on their own in defensive fighting during deep rapid advances into Russia [Ref. 429]. Ideally, German motorized infantry divisions should have stayed with and assisted the *Panzers* in the defensive situations. Still, in 1941, the number of motorized divisions was too few and the scope of operations too great for this to occur in practice. Until relieved by infantry, German *Panzer* divisions were hard-pressed to contain encircled enemy forces. As Red Army units tried to escape from a pocket, the German *Panzers* continually had to adjust their lines to maintain concentric pressure on the Soviet rear guards and to block major breakout efforts [Ref. 430].

2. The Use of Supporting Arms

a. Luftwaffe Antiaircraft Batteries

The German defensive problem was greatly compounded when the Soviet counterattacks included T-34 or KV model tanks, both of which were virtually invulnerable to fire from German tanks. The predicament of the German armor in these circumstances might have been truly desperate had it not been for the fire support that the Army and *Luftwaffe* antiaircraft batteries provided to most of the *Panzer* divisions. Originally assigned to the spearhead divisions to protect them against Soviet air attack, these Army and *Luftwaffe* batteries--and especially the 88mm high-velocity *Flak* guns--had their primary mission gradually altered from air defense to ground support [Ref. 431].

b. Artillery, Flak and Pak against the Russian Tank

To supply additional protective fire for German infantry units on the march, artillery batteries of various calibers were spaced throughout the march columns. By providing responsive fire support to nearby units, these batteries simplified the otherwise complex problem of fire control for scattered, moving, and occasionally intermixed infantry forces. In some units, improvised *Flak* combat batteries, consisting of two 88mm and three 20mm antiaircraft guns, also were distributed among the ground

infantry forces to bolster defensive firepower. Moreover, the dispersal of artillery and antiaircraft units throughout the divisional columns reduced the vulnerability of the guns to ground attack--an important consideration in the chaos of June and July 1941 when bypassed or overlooked Red Army units often appeared unexpectedly along the march route [Ref. 432].

The posting of artillery and *Flak* units in the infantry march columns also lent additional antitank firepower to the foot soldiers. As with the *Panzers* elsewhere, the infantry found its *Pak* antitank guns and antitank rifles ineffective against the T-34 and KV tanks. The result was that the defense against enemy tanks had to be left to the few available 88mm *Flaks*, the 105mm medium guns, and other division artillery. Although the use of artillery in a direct-fire, antitank role was very effective and was consistent with German doctrine in *Truppenführung*--and was, for that matter, in keeping with the German practices of 1917 and 1918--the antitank experience was unpleasant for German gunners. The German artillery pieces and their caissons were cumbersome, had high silhouettes, and were too valuable to be risked in routine duels with Soviet tanks [Ref. 433].

F. RETHINKING GERMAN STRATEGY

1. Russia's Vastness as it affected German Command and Control

In July 1941, the mobility differences between the motorized and non-motorized elements of the *Wehrmacht* caused the Germans, in effect, to advance in two echelons. During the frontier battles of encirclement, the Germans had managed this disparity through their *Keil und Kessel* tactics. The extended distances over which the Germans operated aggravated this problem, opening large gulfs between the advanced *Panzers* and the following infantry. Increasingly, the German forces not only advanced separately but fought separately as well [Ref. 434]. The open areas between German units were populated by Red Army units, and these gaps constituted weak points that could be and were exploited easily by Soviet counterattacks. In one case, bypassed Red Army forces had waylaid the German 268th Infantry Division, causing heavy

casualties and damage. This incident had resulted in the capture of some of the division's artillery and had caused consternation within German command and control [Ref. 435]. The awkwardness of the German position was not lost on the Soviets. On 19 July, Army Group Center reported the capture of a Russian order "indicating that the Russian High Command aimed at separating the German armor from supporting infantry by driving attacks between them" [Ref. 436].

2. Hitler's Interference with Tactical Operations

Hitler began to renew the meddlesome interference in tactical operations that he had practiced in the French campaign. He directed the diversion of German units to "tidy up" and secure the German flanks against lurking Red Army contingents. Hitler carried this idea further in mid-July, de-emphasizing large-scale operations in favor of smashing the enemy "piecemeal by small tactical operations". Senior officers vehemently disagreed with Hitler's designs, arguing that such policies violated the principles of concentration and decisive maneuver [Ref. 437].

While the Germans argued strategy, the Soviets showed that they could, in fact, exploit the fissures in the German front. During the second week of August, strong Russian forces (the Thirty-Fourth Army and parts of the Eleventh Army) thrust into a gap between the German X and II Corps south of Lake Ilmen. Driving north and west from the area south of Staraya Russa, the Russians advanced nearly sixty kilometers by 14 August and threatened not only the flank of the German X Corps but the entire rearward communications of the Sixteenth Army and Army Group North. The divisions of the German X Corps were unable to establish an "Elastic Defense" in depth due to extended frontages and a severe shortage of reserves. Additionally, Army Group North's motorized elements were concentrated in the *Panzer* Group 4 area north of Lake Ilmen. No *Panzers* were available to counterattack enemy penetrations as had been envisioned in *Truppenfuhrung*. The situation was grim since every available man was thrown in. Furthermore, the troops were exhausted [Ref. 438].

3. Crushing the Russian Offensive with Mobile Forces

Hitler was extremely agitated by this Soviet blow and created a stir within the German High Command by frantically ordering mobile units stripped from other sectors to deal with this new emergency. Manstein's XLVI *Panzer* Corps (the 3rd Motorized Infantry Division, and the *Waffen SS Totenkopf* Motorized Division) was detached from *Panzer* Group 4 and brought on a circuitous rearward march to strike the enemy's western flank on 19 August (see Figure 6). The surprise counter stroke quickly caused the Soviet offensive to collapse [Ref. 439].

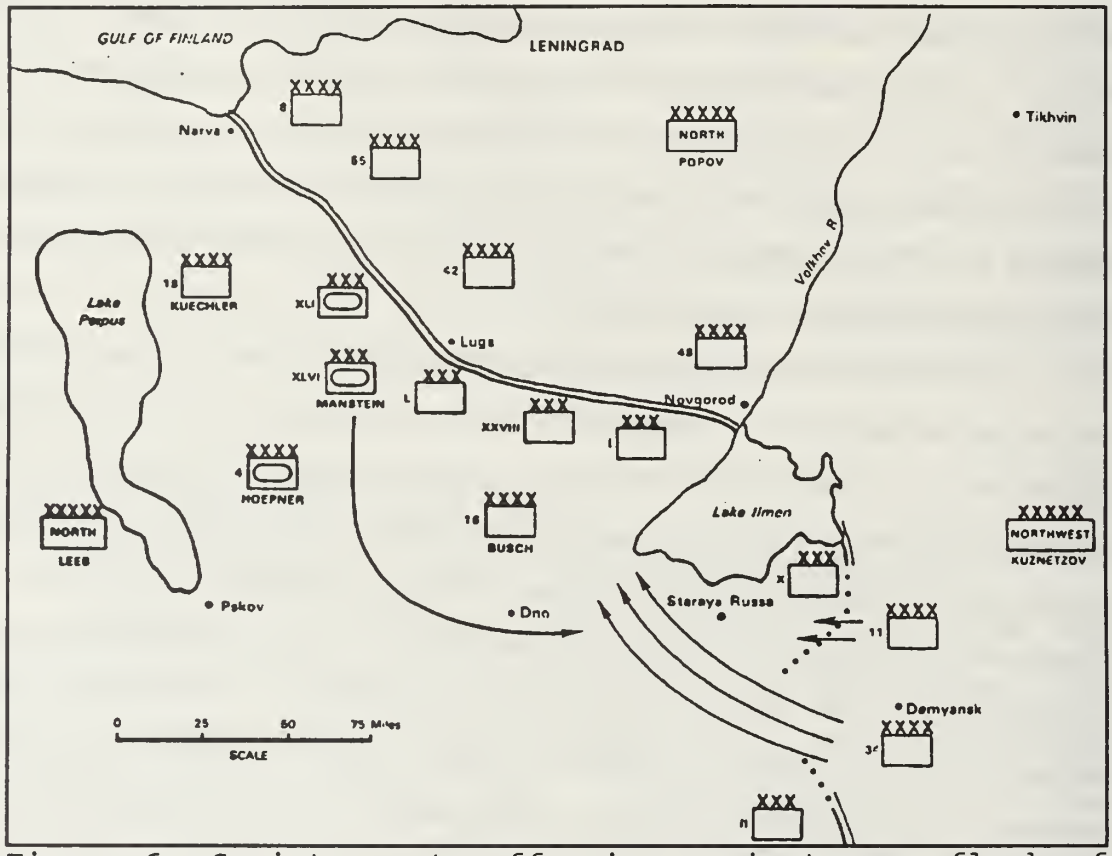

Figure 6 Soviet counteroffensive against open flank of Army Group North and counterattack by Manstein's *Panzer* corps, 12-22 August 1941.

Although the Germans thus could claim victory in this battle--the first substantial defensive crisis on the Russian Front--it bore no resemblance to the neat "Elastic Defense" of German doctrine. The width of the front and the scarcity of forces

had robbed the Germans of their desired defensive depth and ready reserves. Consequently, the German defensive line had stood in imminent danger of collapse until saved by the counterattack of Manstein's mechanized forces. Even this use of German mobile forces had more correctly been a counteroffensive rather than a counterattack, since it had been marshalled and delivered apart from the defensive battle per se [Ref. 440].

G. HITLER'S NEW STRATEGY AND GERMAN COMBAT POWER

On 21 August, Hitler redirected German strategy by ordering new offensive drives on both wings of the Eastern Front [Ref. 441]. Hitler justified this controversial new strategy largely on economic grounds and overruled the military views of the senior officers. The recent Soviet offensive near Staraya Russa probably had helped Hitler make his decision by demonstrating the danger of leaving intact Soviet forces on either flank of Army Group Center. In this respect, Hitler's decided course of action--much criticized by German officers in later years as perhaps the decisive mistake of World War II--seemed militarily prudent since it eradicated, once and for all, the threats to the German flanks [Ref. 442].

Since the beginning of the campaign, the line of contact with Russian forces had stretched by nearly 50 percent, yet few reinforcements had been added to the German order of battle. German combat units were fatigued from the combination of rapid advance and heavy combat experience. On 24 August, for example, General Halder estimated that the combat strength of the German infantry divisions averaged 60 percent of full capacity and the *Panzer* divisions only 50 percent. Conducting offensives to the north and south meant that any drive on Moscow would have to be postponed indefinitely. German units were too dispersed and their combat potential too diminished for such a feat [Ref. 443].

With German forces dissipated, the diverging operations that Hitler had ordered to the north and south dashed the Army High Command's hopes of a climactic advance on Moscow. To lend weight to the attack on Leningrad and the great envelopment at Kiev,

Army Group Center had to relinquish most of its armor and a large share of its infantry. Shorn of its offensive cutting edge, Army Group Center thus had to remain on the defensive until the operations on its left and right were concluded. The defensive battles waged by Army Group Center from the end of July through September 1941 were the first German attempt in World War II to sustain a large-scale positional defense [Ref. 444].

H. THE LOGISTICAL CONSIDERATIONS OF GERMAN COMBAT POWER

Available stocks of fuel, food, and ammunition had sunk to dangerously low levels in many units, and supply deliveries were becoming more erratic as distances increased. The very bad Russian roads were claiming a heavy toll on the mobile units so that German tanks and other motor vehicles desperately needed extensive maintenance. German personnel replacements were running low. The replacement of lost weapons and other equipment was proceeding slowly: the German war economy had not been geared up for Barbarossa, and existing production lagged behind consumption. In anticipation of a rapid victory in Russia, German armaments production was already shifting emphasis away from army material. By December 1941, monthly weapons output had declined by 29 percent from earlier peak production [Ref. 445].

I. ARMY GROUP CENTER, JULY TO SEPTEMBER 1941

1. The Yelnya Salient

Army Group Center, having given up a good portion of its cutting edge in mechanized forces, was forced into a large-scale positional defense. Seized by the XLVI *Panzer* Corps of Guderian's *Panzer* group on 20 July, the Yelnya salient enclosed a bridgehead over the Desna River plus high ground that was valuable for the continuation of German offensive operations toward Moscow. If Yelnya had strategic value as a foothold from which future offensive operations might be launched, it also carried tactical liabilities: it was surrounded on three sides by powerful Soviet forces [Ref. 446]. The 10th *Panzer* Division and the *SS das Reich* Motorized Division had captured Yelnya and had to hold it until Guderian could bring up marching infantry.

As with the containment of surrounded pockets during encirclement battles, this sort of independent defensive action by *Panzer* and motorized forces had not been envisioned in German prewar manuals on defense [Ref. 447].

The two German mobile divisions fought at a severe disadvantage. Both units were fatigued and undermanned from their earlier offensive efforts. Ammunition and fuel were scarce, and the confining terrain within the salient nullified their mobility and shock effect. The 10th *Panzer* Division suffered from the shortage of infantrymen endemic to such units and therefore was poorly suited for positional defense. Guderian, to offset these handicaps, had requested that the *Luftwaffe* concentrate close air support in the Yelnya area. But the *Luftwaffe* was diverted to protect the southern flank of Army Group Center [Ref. 448].

The early phase of the fighting at Yelnya showed that operational requirements would not allow the Germans the luxury of using their mobile *Panzer* forces in only offensive roles. This fighting had again showed the unsuitability of using infantry-poor *Panzer* units in static defensive operations. Catastrophe was averted through the timely arrival of infantry reinforcements, which became available as Russian resistance in the Smolensk *Kessel* died on 5 August. Guderian quickly moved infantry divisions into the Yelnya salient, hoping that their greater defensive capacities would repel the Russian assaults [Ref. 449]. At Yelnya, the Germans were forced into regular positional warfare.

The width of the front held by Army Group Center precluded the use of the "Elastic Defense", since insufficient forces were available to create defensive depth and reserves ready for counterattack. Furthermore, no logistical provisions had been made for a prolonged defense. German forces lacked the stockpiles of supplies and ammunition necessary for sustained positional warfare. The weak forces and improvised defensive posture of the army group virtually invited disaster [Ref. 450].

2. Supporting Arms Employment at Yelnya

The Germans were hampered in their attempts to beat back the Russian attacks with firepower. The shortage of artillery ammunition around Yelnya diminished large-

caliber fire support and German small-arms fire was diluted by the wide unit frontages. With artillery rounds in short supply, the Germans could not afford to conduct counterbattery fire or even counterpreparations against suspected enemy attack concentrations. In sharp contrast, the Russians hammered the German lines unrelentingly. The Soviet bombardments included not only artillery and mortar shells of all calibers, but also the fearsome new *Katyusha* rockets and strikes by Russian planes. German prisoners taken by the Soviets at Yelnya confessed that the heavy shelling--especially in comparison to the weak German response--badly hurt German morale. More directly, since bombardment always plays a major role in positional warfare, the greater weight of Soviet artillery fire probably caused a proportionately higher German daily casualty rate [Ref. 451].

The Germans had waged an improvised defense on unfavorable ground. Because of the extended unit frontages and inadequate combat resources, a doctrinal "Elastic Defense" relying on depth, local maneuver, firepower, and counterattack had been impossible. Army Group Center paid an extraordinarily high price in blood. Whereas the "Elastic Defense" had been designed to minimize personnel losses in positional warfare even in the face of enemy superiority, the improvised methods that the German units were compelled to use in the central front battles resulted in heavy casualties [Ref. 452].

J. WINTER BATTLES AND GERMAN STRATEGY, 1941-42

1. Hitler's Policy of No Retreat and German Command and Control

At the strategic level, the December crisis on the Eastern Front caused Hitler to override his military advisers' recommendations by enacting a face-saving, no-retreat policy that callously risked the annihilation of entire German armies. His patience with independent-minded officers finally at an end, the German dictator then followed this strategic injunction with a purge of the German Army's senior officer corps that left the Fuhrer in direct, daily control of all German military activities. These events had ominous long-term implications in that Hitler's personal command rigidity, together with

his chronic insistence on "no retreat" in defensive situations, eventually corrupted both the style and substance of German military operations [Ref. 453].

Hitler relieved more than thirty generals and other high-ranking officers who had been corps commanders, division commanders, and senior staff officers and replaced them with elevated officers of unquestionable loyalty or officers of known Nazi sympathies. In a further step to cement his authority, Hitler forbade voluntary resignations, thereby denying the German officer corps the traditional soldierly protest against unconscionable commands [Ref. 454].

While the removal of unruly senior officers made the German Army more docile, these turnovers adversely affected German military performance as follows [Ref. 455]:

1. The turnover of so many commanders in the midst of desperate defensive fighting disrupted the continuity of German operations. The newly appointed leaders, who frequently brought with them new chiefs of staff, normally required an adjustment period before they could discharge their new duties with complete confidence, In fact, some replacements could not adjust at all. General Ludwig Kubler, who replaced Field Marshal Gunther von Kluge as Fourth Army commander when Kluge replaced Bock, found Hitler's stand-fast strategy intolerable and requested his relief barely a month after assuming command. The net effect of all this turmoil was to minimize bold initiatives at the Front and to concede most strategic and operational control to the Fuhrer by default.

2. By sweeping away those officers who had the temerity to challenge Hitler's strategic views an important source of advice and assessment was silenced. For the remainder of the war, responsible criticism of the Fuhrer's design was muted by the threat of punishment. Therefore, for the next three years, German military strategy lurched from disaster to disaster due mainly to Hitler's having banished or intimidated into silence those whose courage, skill, and judgement best qualified them to act as independent advisers.

3. By removing so many senior leaders and by inserting himself at the top of the chain of command as army commander-in-chief, Hitler profoundly altered the command philosophy of the German Army. For generations, commanders in the Prussian and German Armies had been schooled to direct operations according to the principle of *Auftragstaktik*. This principle constrained commanders to give broad, mission-oriented directives to their juniors, who were then allowed maximum latitude in accomplishing their assigned tasks. Senior leaders trusted implicitly in the professional discretion of their subordinates, and German operations characteristically

showed a degree of imagination, flexibility, and initiative matched by few other armies. So deeply ingrained was this philosophy that actions contrary to orders were seldom regarded as disobedience, but rather as laudable displays of initiative and aggressiveness. According to a German military adage, "Mules could be taught to obey but officers were expected to know when to disobey" [Ref. 456].

Hitler's rigid and overbearing insistence on the literal execution of all orders corrupted *Auftragstaktik*. The harm done to the German command and control philosophy was not confined to upper echelons. Hitler's stifling, obedience-oriented style was transmitted throughout the German Army so that operations at all levels suffered its inhibiting effects. Senior field commanders were thus pressed to control more closely the operations of their subordinates [Ref. 457].

This corrosive process was abetted by two features of the World War II battlefield. The first was modern radio communications, which enabled senior commanders to direct even remote combat actions. This not only invited greater interference, but spawned timidity at lower levels by conditioning subordinates to seek ratification of their decisions from their superiors before acting. Second, the chronic lack of German reserve units--a circumstance particularly pervasive on the Eastern Front--reduced the ability of senior commanders to rectify the mistakes of subordinates and thus encouraged the centralization of battle direction at higher levels [Ref. 458].

2. Soviet Counteroffensive Tactics

The Soviet winter counteroffensive prompted significant changes not only to German strategy but to German tactical methods as well. These alterations emerged during the winter fighting and helped shape the German defensive practices that were used throughout the remainder of the war [Ref. 459]. For weeks before the Russian onslaught, German units had been reporting incessant enemy counterattacks during their drive toward Moscow. So routine had these counterattacks become that German analysts did not recognize immediately the Russian shift from local counterattacks to a general counteroffensive. Since the Germans had seemingly ruled out large-scale offensive operations for themselves due to heavy losses, supply difficulties, and severe weather conditions, they supposed the Russians would do the same. In fact,

the intelligence supporting Fuhrer Directive 39 discounted the Red Army's ability to mount more than limited attacks during the coming winter [Ref. 460].

Because real operational flexibility no longer existed in the German Army from the winter of 1941-42 onward, German defensive actions on the Russian battlefield were adversely affected. Hitler's orders to the German Army to stand fast established the framework of German defensive strategy. The elimination of strongheaded and difficult-to-handle senior officers gave authority to that strategy and gradually narrowed the discretionary latitude of subordinate leaders to act independently. It remained for the combat units themselves, coping as best as they could with dreadful weather and a tough enemy, to give substance to the German defense [Ref. 461].

K. THE STRONGPOINT DEFENSE

1. Hitler's Stand-Fast Order and the Inception of the Strongpoint Defense

At the tactical level, German defensive practice during the winter of 1941 was dictated by Hitler's stand-fast order, the appalling tiredness of the German units, and the harshness of the Russian winter weather. These three factors forced the Germans to use a defensive system that consisted mostly of a network of loosely connected strongpoints backed by local reserves. This strongpoint defense lacked basis in prewar German doctrine and was wholly improvised to fit the particular circumstances existing at the time [Ref. 462].

Although some Germans later represented the strongpoint defense as being a shrewd method of slowing a superior enemy by controlling road junctions, any such success was largely coincidental. The strongpoint defense was, first and foremost, a tactic of weakness. German commanders did not choose to fight from village-based strongpoints due to any cunning assessment of Soviet vulnerabilities. Rather, the German winter defense coagulated around towns because Hitler forbade voluntary withdrawals and because the winter weather lashed at unprotected German units that tried to stand in the open [Ref. 463].

2. The Effects of Losses in Weapons and Equipment

By mid-December, field artillery pieces, antitank guns, motor vehicles, and tanks were all in particularly short supply. *Panzer* Group 4 estimated on 18 December that only 25 to 30 percent of its heavy weapons remained in action, while *Panzer* Group 3 counted only twenty-one artillery pieces of 100mm or larger still operational among its six divisions. The LVI *Panzer* Corps had lost so much of its equipment that it remained a corps-size unit in name only. Its four *Panzer* divisions together mustered only thirty-four tanks and its 6th *Panzer* Division had no running tanks at all. This lack of heavy weapons further diminished the Germans' ability to hold continuous positions, while the shortage of effective motorized forces foreclosed the possibility of any type of mobile defense [Ref. 464].

This overall impoverished state of German units made a renewed linear defense impossible. Not only could assigned frontages not be covered, but any such extended deployment would further disperse what few troops and weapons remained. So, to prevent German combat power from evaporating altogether, German company and battalion commanders instinctively drew their beleaguered units into small strongpoint garrisons when Hitler ordered them to "fanatical resistance" [Ref. 465].

L. THE CONDUCT OF STRONGPOINT DEFENSE

1. The Use of German Supporting Arms

A major difficulty, now apparent to German commanders for the first time, was that defensive training had been deficient. To compensate for their inexperience, German units shared combat know-how by exchanging hastily prepared battle reports. Officers began by surveying the available buildings to identify those best suited for defensive use. Houses selected as fighting positions were then transformed into miniature fortresses capable of all-around defense: snow was banked against the outer walls and sheathed with ice, overhead cover was reinforced, and firing embrasures were cut and camouflaged with bedsheets. When available, multibarreled 20mm *Flak* guns were integrated into the defense in special locations. These consisted of houses with their roofs purposely torn

off, the floors reinforced, and the exterior walls covered with a snow-and-ice glaze to gun-barrel height. These "*Flak* nests" helped keep both Soviet aircraft and infantry at bay [Ref. 466].

Defensive combat from such positions was, according to a 19th Motorized Division report, primarily "a question of organization", requiring careful use of all available heavy weapons and artillery. When enemy attacks seemed imminent, German artillery fire and air attacks were directed against known and suspected enemy assembly areas. As Soviet forces approached the strongpoint, the fire of heavy mortars, antitank guns, and heavy machine guns joined in. Such fire was carefully controlled, since experience showed that it is inappropriate to battle all targets with single artillery pieces and batteries. It is much more important to strike the most important targets using timely, concentrated fire to destroy them. Any enemy infantrymen who worked their way into a village were either cut down by interlocking fires from neighboring buildings or wiped out by the counterattacks of specially designated reserves. Armed with submachine guns and grenades, these reserve squads were launched against any penetrating enemy troops before they had a chance to consolidate [Ref. 467].

A technique for giving depth to the German defense was to array heavy weapons (light "infantry" howitzers, antitank guns, *Flak* guns, artillery pieces) and artillery observers in depth behind the forward strongpoints. Enemy forces penetrating beyond the strongpoint line thus could be continuously engaged by direct and indirect fire to a considerable depth. Though weakening the direct-fire capabilities of the forward strongpoints somewhat, this technique did not require the displacement of the snowbound German guns in order to fire on penetrating Soviets. Furthermore, the fortified gun positions also served as additional pockets of resistance against further Russian advance. Even though this technique complied with doctrine, under the circumstances it was a desperate expedient because it risked sacrificing the precious German artillery simply to contain ground assaults [Ref. 468].

The German heavy weapons were far more valuable for their ability to smash advancing Soviet formations by fire. By careful fire control, German commanders used

their concentrated firepower to slow, disrupt, and occasionally even destroy Soviet penetrations outright. As explained in one after-action report, "Rapid concentration of the entire artillery on the enemy's main effort is decisive." To that end, German divisions meticulously integrated the fires of all major direct- and indirect-fire weapons (including infantry mortars and heavy machine guns), also the fires of neighboring units, into a single division fire plan. This prearranged fire plan was then executed on the order of designated frontline commanders so that attacking Russian troops were suddenly ripped by simultaneous blasts of concentrated artillery and small-arms fire [Ref. 469].

2. The Drawbacks of the Strongpoint Defense

German units soon realized that strongpoints confined to small villages had serious drawbacks as well as advantages. The Soviet armor posed a deadly threat to house-based defenses. Since camouflage could not hide buildings, Russian tanks had little difficulty in identifying and engaging the German positions concealed therein. Besides, if successful in driving the Germans from their building shelters and into the open, the enemy tanks could slaughter the fleeing Germans almost at leisure [Ref. 470].

Strongpoints inside villages virtually conceded control of the surrounding area to the Red Army. This reduced German reconnaissance and left the strongpoint susceptible to encirclement or night attacks by stealth. The Russians used night attacks to disrupt the carefully orchestrated German fire plans [Ref. 471].

Strongpoints restricted to congested areas formed "man traps" since they made ideal targets for Soviet artillery. This forced the Germans to defend such strong points in the surrounding terrain. The 7th Infantry Division learned to avoid unduly concentrating troops in villages even when no other positions had been prepared [Ref. 472]. German units gradually refined their strongpoint defenses by pushing defensive perimeters beyond village limits. This helped to conceal the German positions, increased security against surprise attacks, and gave sufficient dispersion to avoid easy annihilation by Soviet artillery. These extended perimeters also reduced the distance between neighboring units and made it more difficult for Russian patrols to locate the gaps between strongpoints [Ref. 473].

M. LESSONS LEARNED

Even average intelligence work on the Germans' part would have indicated the Russian build up: material being brought forward, construction of dummy artillery positions, improvement of roads and paths, detailed rehearsals in the Russian rear area by the assault troops, and aggressive patrolling. The large tank formations were last to arrive in the assembly area. The best solution in dealing with such a build up would have been for the Germans to use air power and artillery to pound this area, particularly the artillery positions and the forward assembly area [Ref. 474].

Until late 1944, the large Russian artillery preparation served as an "alarm clock" to warn the Germans of the impending attack. The Soviets began to vary the timing and pattern of their traditional rolling barrage. They did this because German infantry had learned to withdraw from the first to the second trench during the barrage and, immediately following the barrage, move back to the first trench. So, the Soviets began using "feint barrages," which usually took place two to three hours before the actual attack, to determine the Germans' intentions. The Germans' solution to this problem was to move back to another trench line and have their artillery fire concentrate on the forward Soviet positions. Once the attack began, Soviet infantry focused now on the unoccupied German front lines (the initial Soviet assault objectives). German artillery concentrations on these positions proved effective until the Soviets learned to avoid occupying enemy positions [Ref. 475]. Following the end of the rolling artillery barrage, there was usually a lull in Soviet artillery activity. There were so many guns that, when they attempted to move forward, they created ever worsening traffic jams. Such traffic jams provided lucrative targets for the German Army [Ref. 476].

Ten minutes before the rolling barrage passed the German front line, Soviet infantry units opened fire with heavy weapons to keep the Germans pinned down. The assaulting Soviet infantry hoped in this way to arrive at the German positions while the German defenders were still in full cover. To nullify this tactic, Germans constructed concrete shields with observation and firing ports [Ref. 477].

The triumphant lightning warriors of Europe were forced to concede their "Elastic Defense" was useless in the open spaces of Russia. The German Army used whatever means at hand to best advantage, but could not overcome the obstacles. The simplest logistical problems became difficult when the *Wehrmacht* was faced with the vast territory that reduced cohesion, the extended fronts that required mobility to cover, the poor roads that hampered progress, the lack of manpower and reserves that reduced combat power, and the bitter Russian winters that drained the spirit. Add to all this the fanatical mistakes of an aggrandizing leader who demanded all command and control and the task facing the longsuffering German Army became insurmountable.

VII. OBSERVATIONS AND CONCLUSIONS

The heart of German combat power was its offensive doctrine. The German campaign of May-June, 1940, incorporated ideas that had originated with at least seven men: Clausewitz, Hutier, Seeckt, Fuller, Liddell Hart, Guderian, and Manstein [Ref. 478]. While no single man can be credited with the *Blitzkrieg* concept of warfare, it was this melding together of ideas that lies at the very core of the German Army's creative ability and its self-examination, which lead to the development and evolution of German doctrine. Above all, German Army philosophy of command and control was the source of its success in World War II.

The essential purpose of the German command and control and the driving force behind the German attack was to gain and then maintain the initiative at all times [Ref. 479]. The German Army recognized that uncertainty must be met with aggressive action. Personalities capable of such action were sought and developed in German commanders. The two factors of a German attack were surprise and speed which resulted in maneuver and movement[1]. It was through maneuver and movement that concentration of German arms was gained, a key to German superiority of force. German combat power was an extremely flexible force localized at the precise point of need against the weak points in the enemy's defense. Movement was the driving force behind German firepower in producing surprise; which destabilized the enemy's command and control structure.

The German Army exploited every facet of war, the enemy's friction, the uncertainty, the fluidity and tempo, the disorder, the human dimension and the moral. The *Blitzkrieg*, which became the German Army's trademark, utilized the offense while exploiting the power of the defense. The German Army became masters at a style of warfare that emphasized concentration, speed, surprise and boldness, to exploit

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[1] Maneuver is defined as stratagem and movement, a subset or lesser form of maneuver, as the action.

vulnerability and opportunity. The German Army applied the combined tactical and operational lessons of history. This is not to say the Allies did not learn these same lessons. What prevailed in the end was their ability to apply lessons learned. The German Army simply saw and used ideas that reflected battlefield reality, better than their enemies.

The ultimate supremacy of the offensive was one of the theories established in the early months of World War II. By efficient use of tanks, trucks and aircraft, the Germans solved the problem that baffled World War I commanders: the strategic breakthrough. The German Army exploited penetrations faster than the Allies could move new units to fill the gaps in the defense [Ref. 480].

The French claimed their military difficulties in World War II were caused by internal political weaknesses. A divided nation fell before the powerful shock of a bold military stroke. Political quarrels undoubtedly had an adverse effect on the national effort; still, the Germans admitted that the French as well as the Poles fought courageously. Also, material deficiencies alone would not account for the rapid collapse of the French effort. Senior German officers credited their victories to other causes. General von Mellenthin emphasized German leadership and doctrine, correct utilization of armor with air power, and the combined arms principle; General von Thoma, a tank expert, stressed concentration and cooperation of armor and aircraft, aggressive exploitation of success, excellent logistical planning, and weak enemy anti-tank defenses; Manstein gave credit to superior German troops and leaders, audacious employment of armor and airpower, and Allied tactical mistakes; General Blumentritt praised superior German organization, air-tank cooperation, and the high quality of German leadership [Ref. 481].

Views similar to those of the Germans' were voiced by Liddell Hart, who attributed the German victory in France to new tactics and weapons, Manstein's audacious plan of attack through the Ardennes, the skill of the German generals, and the blunders of the French generals. These factors made possible the *Blitzkrieg* that paralyzed the French Army. The most serious Allied blunder was the offensive thrust into Belgium by the best

British and French divisions, a move which cost the Allies most of their mobile reserves [Ref. 482].

General Fuller saw things differently. The major Allied error, he believed, was the failure to assemble tanks into large armored units and concentrate them on the French-Belgian frontier. Allied tanks were numerically and technically superior to the German tank, but were misused tactically [Ref. 483]. The headlong rush by the Allies into Belgium, although defensible as a political gesture, was a major military blunder. The Allied plan was defensive; British and French divisions had moved into Belgium to take up defensive positions when the strong German armored corps sliced behind them. The Allies were compelled to fight a battle of movement and maneuver and for this type of warfare the Germans were prepared far better technologically and psychologically [Ref. 484].

During the War's early years, the German Army adhered to the doctrinal principles of the "Elastic Defense" as detailed in the 1933 manual *Truppenführung* insofar as possible, relying on local commanders to make any necessary adjustments to suit their own circumstances. Most doctrinal changes were done informally, originating at the front lines where local commanders acted on their own initiative to correct inappropriate tactical methods. The constant updating of German defensive methods was highly decentralized. Units worked out new procedures that became doctrine when drilled into replacements and when passed on to other units via combat reports. The principal benefit from decentralization was that German units adapted swiftly and automatically to the harsh realities of combat in Russia. These improvisations, which probably saved the German armies from annihilation, owed less to published doctrine than to the insight, experience, and tactical judgement of local commanders. In contrast to the rigidity of the Red Army, the German adaptability was apparent early in the war [Ref. 485]. Certain tenets remained constant throughout the war and formed the true heart of German doctrine. The German Army's defensive methods were derived from four basic principles: depth, maneuver, firepower, and counterattack. Through all the variation in defensive methods, these principles continued to guide German commanders in conducting

their operations [Ref. 486] and can be seen in the application of supporting arms. Even in the defense, speed was emphasized more than mass, which was the underlying principle of German doctrine. Every unit in contact with the enemy, down to the individual squad, was trained to initiate its own counterattack without awaiting either orders from superiors or the arrival of reserve forces [Ref. 487]. This is another key to the offensive spirit of German doctrine.

In practice the German defensive operations never corresponded exactly to prewar doctrine. In no single campaign or engagement did German battlefield performance on the Eastern Front between 1941 and 1943 follow the visions of *Truppenführung* and other prewar manuals. This is because peacetime preparations never can anticipate the exact circumstances of combat. Thus, in war, the tactical methods learned during peacetime maneuvers simply do not survive intact, and individual soldiers and whole units must learn quickly to adapt themselves to battlefield conditions. The German Army, like any army stepping from peacetime into wartime, was forced to alter its visions to reflect actual battlefield circumstances [Ref. 488].

The German *Wehrmacht* battled long and well before falling before the combined might of the Allies. Although lacking an effective defensive doctrine and fighting against a substantially larger force, the German Army fought admirably against the better-equipped Soviets in the final phase of the war. This again is a testimony to German command and control and its dynamic response to circumstances. The German system rewarded clear thinking and innovativeness in its officer corps more than other army of that time. It was the German Army's ability for self-evaluation and rewarding creativeness that gave it a defensive capability in the absence of a sound defensive doctrine.

The German style was to fight on the offensive, move 24-hours a day, master uncertainty by action, show creativity in command and seize objectives. This style both supported the overall mission and allowed subordinate leaders to make mistakes and then benefit from them. The advances in Russia were based on self-confidence and great initiative by the commanders, the staffs and the rank and file. The German command

style and leadership pivoted on taking action in war, demanding that subordinate leaders take such action, and accepting the mistakes that naturally occurred. With such a style, the German commanders accepted uncertainty as an omnipresent reality [Ref. 489].

The German Army fielded a command and control system influenced by the German General Staff, an elite group of officers not paralleled anywhere among the Allies. Everything was structured for maximum efficiency of the system. Commanders' leadership style, communications, even medals reflected the cohesion of the German Army's command and control system. The German system emphasized offensive spirit in combat and imposing its will on the enemy. The German command and control structure was organized to facilitate decentralization to deal with the uncertainty of war. Decentralization was controlled by issuing mission-type orders, by utilizing the German system of communications and by commanders placing themselves up front to take advantage of opportunities and to facilitate quick responses. Uncertainty is "real world" and the German Army viewed it as an asset rather than a hinderance. The matrix structure of the German Army lent itself to ad hoc battle groups that could dominate the battlefield. The German Army, therefore, structured its training to embrace the reality of uncertainty in battle through decentralization in the offense and task organization through battle groups.

The German Army's effectiveness can be attributed to the following:

- Its doctrine, its style of command and control and its offensive spirit,
- Its experience before and during the war,
- Its training and its leadership,
- Cohesiveness aided by its communication, its self-analysis and its incentives and system of reward,
- Initiative that was built in organizationally and inculcated in the officer corps.

The German Army organized for combat through a task-oriented matrix organization. The hierarchical command and control structure used by the Allies, with the commander at the top, implies that command authority proceeds downward and has

a diminishing scope at each level. One assumes that at each level information and data is available from below by demand but from above only by grace [Ref. 490]. The German Army recognized that senior commanders do not have the resources or capability to make timely decisions at the lowest levels. In order to optimize combat power they used matrix-type organizations. This decentralization of command and control culminated in the form of battle groups. The German system for communication infused the will and the intent of the commander into every level of command, clearly defining the unique perspective of each commander and ensuring the tactical cohesion of combat power.

The German Army placed great emphasis on unit cohesion through discipline. However, discipline without judgement or obligation to subordinates is tyrannical and selfish and will not stand up under scrutiny. In time, Hitler secured a stranglehold on the German *Wehrmacht* through the OKW. No organization can flourish or continue to survive without input or feedback. The OKW allowed Hitler to communicate his intentions but precluded the branches of the military from interjecting and providing the necessary feedback. Hitler eventually paralyzed the German command and control system and destroyed the flexibility of the *Wehrmacht*. If discipline is to serve an army its underlying tone must be responsibility and obligation to both subordinates and seniors. With increased discipline, communications become implicit rather than explicit, ultimately leading to the desired result of decentralization. Such was the German Army of the Second World War. This was one reason (doctrine being another) they were so successful at the operational art and tactical levels of war. The Germans made every effort to maintain discipline while taking down unnecessary barriers between the officer corps and the enlisted ranks. Rommel, as well as the majority of the German officer corps, understood this and shared hardships with troops and officers alike.

The development of aviation in the period between the wars was accompanied by the development of the theory of its use in different forms of armed conflict. For example, aviation was viewed in Germany and Japan as a highly mobile, powerful, attack resource to destroy or pin down the enemy's ground troops and naval forces and to assist

friendly troops in various operations on land and at sea. In France, England and the United States, aviation was counted on more as a strategic resource for strikes against the enemy's economic installations and somewhat less as a tactical resource for supporting ground troops [Ref. 491]. Allied airpower demonstrated that surgical strikes made by fighter/bombers were more effective than massive bombings. The mass bombings were analogous to the huge artillery bombardments of World War I. If they had been effective the unrelenting strategic air bombardments of World War II should have brought the German Army to its knees long before Germany capitulated. The Germans showed that to be successful in their contribution to victory, the effects of airpower must be capable of being fully exploited by the ground forces. The *Stukas* were essentially used as airmobile artillery to support a fast ground attack in order to suppress the enemy so the German ground force could breach the enemy defenses.

German command and control was very perceptive in its application of supporting arms, providing enough support but rarely too much. Airpower was used as the vanguard supporting arm for the German *Blitzkrieg*. It could flexibly deliver a tremendous amount of ordnance in a relatively short period of time and at the same time protect German flanks. The German Army recognized that towed artillery required an initial time lag to bring artillery fires to bear and astutely used the *Luftwaffe* to augment those fires. Additional time was necessary if a battery or battalion fire direction center were used. German decentralization of artillery enhanced fire support and placed combat power well forward where it was needed. Artillery in battle groups was placed near the front on the axis of advance. When the battle did develop, the towed artillery could be swung into action and at times, was so close, it engaged the enemy in direct fire, eliminating the need for the fire direction center. This ensured responsive, relatively light but adequate artillery support, enhanced by initiative and self-confidence on the part of artillery commanders. Often times, in the absence of detailed instruction, artillery commanders directed the fires against the enemy positions, quickly developing the battle and allowing infantry to smash through enemy resistance by immediate aggressive assault.

In great, sweeping operations towed artillery could not provide massed fire support to widely scattered mobile units. Mechanized forces also out-ranged the fan of artillery fire quickly. Through decentralization, battle groups, with attached artillery placed well forward on the axis of advance, could push 100 kilometers beyond frontline German units. The attached artillery provided enough support to the battle groups until larger forces arrived. The battle groups again leaped forward boldly, striking again at the enemy's equilibrium, never allowing the momentum of battle to be lost due to the wait for massive attrition style artillery fires.

The foundation of the German style of providing enough fire support had its inception towards the end of the First World War under LtCol Georg Bruchmueller. That style concentrated on providing enough artillery at the right time and was quickly adopted by several higher German commanders. The style revolved around ultra brief massed centralized fires and nimbleness of support, and the German Army was able to mass artillery in defensive as well as offensive situations. The German style of war can be characterized as bold, deep strategic moves. The command and control of artillery was designed not to inhibit the thrust of tanks and infantry but to provide sufficient and flexible fire support. Limited German resources made time the one inflexible factor behind the lighting war because the German Army could ill afford to be engaged for long periods of time with its opponents. Streamlined forces required efficient use of combat power. Sufficient fire support was the foundation upon which the German Army built its supporting arms.

The command and control of World War I artillery was inflexible, it did not meet the needs of infantry and it tended to be self-serving. Bruchmueller realized this and laid the foundation for decentralized artillery command and control. He emphasized that it was artillery's job to support the infantry and not vice versa. Artillery commanders were the ones to make liaison with infantry and ensure support. Between the wars decentralization of German artillery evolved to provide a flexible, yet sufficient, means of fire support for the German Army during the Second World War.

Bruchmueller understood not only the physical effects of artillery but its physiological effect as well. He insisted artillery use Met + VE (metrological data plus velocity errors) to register the howitzers vice the usual ranging shellfire thereby achieving total surprise when the German artillery opened up[2]. Additionally, he perceived seven days of artillery preparations for an attack were not necessary for success and he massed artillery for two to five hours. To emphasize the physiological effects of a massive bombardment to neutralize enemy resistance, he used artillery in three phases. The first isolated the battlefield by engaging deep targets. The second targeted enemy command and control centers, logistics, communications and artillery. The final phase targeted the enemy front line positions either to suppress or neutralize the enemy infantry, allowing German forces to smash through and destabilize the enemy's rear areas. While there was some overlap and in some cases reattacking the same targets in different phases for tactical reasons, these three phases were the basis for the German artillery attack. It was in the use of gas that Bruchmueller demonstrated his understanding of neutralization and used it decisively. It gave an additional effect to the normal artillery fires using high explosive ammunition.

The assault artillery evolved because of the highly offensive orientation of the German Army [Ref. 492] and decentralization of command and control. The German tactics of placing (assault) artillery far forward allowed the German combat arms to develop the battlefield and quickly adapt to swift changes within the environment. This allowed the immediate application of artillery combat power at the point of need. Long-distance artillery support and infantry mortars could have provided indirect fire support. While irreplaceable, they did not ensure that German attacks consist exclusively of offensive operations. Assault artillery crews and supported infantry units developed a very close personal working relationship that strengthened combat effectiveness. An important task of assault artillery (as well as artillery in depth) was to provide antitank

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[2] Met + VE is a mathematical registration vice the physical registration of ranging the shell's impact.

fire because tanks are the main weapon of a large scale attack [Ref. 493] in open terrain.

The need for an infantry artillery pieces becomes somewhat blurred in light of the mortar because the characteristics of the mortar weapons system are better suited to infantry needs. The need for assault artillery in support of mechanized infantry is a different matter due to its maneuverability, its ballistic shield, and its speed. The German success during the Second World War can be attributed to speed and maneuver rather than firepower. The need for assault artillery lies in its moral and also its physical effects. It gives the infantry a weapon that can lend weight at a precise point of need and adds to the fighting strength both morally and physically.

The ballistic characteristics of the howitzer (which has medium to high-angle fire and medium muzzle velocity plus a lack of modern antitank rounds to destroy armor) do not lend themselves to an effective antitank weapon. While no artilleryman wants to go one-on-one with a tank, it is operationally necessary, with maneuver warfare, for artillery to be able to stop an armored attack in rear areas. This can be done through realistic training with effective antiarmor artillery rounds to gain the required muzzle velocity/flat trajectory. Optics are needed that are enabled with laser range finders to engage armored targets at sufficient range and make artillery competitive with tanks. Training should be not only in terms of gunnery but in terms of artillery employment against mechanized attacks. Crews need to be taught to dig weapons into the ground. This would prove beneficial against air strikes and indirect fire not only for ballistic protection but to decrease the howitzers' silhouettes against direct fire weapons.

While all arms of a service are important, it is ever and always the foot soldier, with a light and mobile personal weapon, who captures the ground, secures it, defends it and holds it and who is the irreplaceable factor. He is irreplaceable because he is physically present upon the ground and holds it in a way that no machine ever will [Ref. 494]. While tanks and mechanization revolutionized warfare and produced staggering results there can be no doubt that, as far as the German Army was concerned, it was chiefly upon the infantry that the main burden of battle fell and that it

was they who suffered the heaviest losses. It was their incredible marching ability which set the seal of victory upon those battles that the armored forces had initiated. It was the foot solider who had to fight his way through villages and forests and across vast areas of the Steppes. [Ref. 495]

The German Army produced probably the most complete system of command and control ever seen up to the Second World War, nearly accomplishing domination of the largest segment of the civilized world since the Roman Empire. While one cannot admire the actions of the German political leaders, one can appreciate the remarkable system of leadership and tactics and associated command and control with which the German officers and soldiers seemed to produce superhuman results. The Allied leaders, e.g., Churchill and Montgomery, openly expressed their admiration for the German Army effectiveness in combat. The present-day employment of supporting arms owes much to the innovative German military planners of the First and Second World Wars and the emphasis they placed on flexible support of both infantry and tank forces. The German Army's style of command and control led to unmatched success in battle in World War II and suggests emulation.

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17. This text is the comment of Prof. Wayne P. Hughes, Jr., one of my thesis advisors. Prof. Hughes and the book he wrote, Fleet Tactics, have had a positive impact on this thesis, to which I add the words used by Dr. Bradley J. Meyers (see endnote 64) in his doctoral dissertation:

> "The book Fleet Tactics, by Wayne Hughes, shows how concrete elements of tactics, weaponry, communications, scouting and so on influenced some fairly generalized (ie., "operational") questions of naval warfare, such as whether the fleet should fight united or divided. Hughes' book, even though it deals with war at sea, was an inspiration to the author in deriving the interpretation of Moltke's military system. See Wayne P. Hughes, Jr., Fleet Tactics: Theory and Practice (Annapolis, Naval Institute Press, 1986)."

18. These are the words of Prof Wayne P. Hughes, Jr.

19. FMFM-1, "Warfighting", U.S. Marine Corps, p. 6.

20. FMFM 1, "Warfighting", U.S. Marine Corps, p. 7.

21. FMFM 1, "Warfighting", U.S. Marine Corps, pp. 7-8.

22. FMFM 1, "Warfighting", U.S. Marine Corps, p. 8.

23. FMFM 1, "Warfighting", U.S. Marine Corps, p. 9.

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26. FMFM 1, "Warfighting", U.S. Marine Corps, p. 11.

27. FMFM 1, "Warfighting", U.S. Marine Corps, p. 12.

28. FMFM 1, "Warfighting", U.S. Marine Corps, pp. 12-13.

29. Rolak, Bruno J., "European Military Thought in the 1930's" A Thesis for the Degree Doctor of Philosophy at Indiana University, Degree Date: 1968, p 88.

30. This text is the comment of Prof. Wayne P. Hughes, Jr.

31. FMFM-1, "Warfighting", U.S. Marine Corps, p. 24.

32. FMFM-1, "Warfighting", U.S. Marine Corps, p. 25.

33. FMFM-1, "Warfighting", U.S. Marine Corps, p. 25.

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42. FMFM-1, "Warfighting", U.S. Marine Corps, p. 31.

43. FMFM-1, "Warfighting", U.S. Marine Corps, p. 31.

44. FMFM-1, "Warfighting", U.S. Marine Corps, p. 31.

45. FMFM-1, "Warfighting", U.S. Marine Corps, p. 32.

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49. FMFM-1, "Warfighting", U.S. Marine Corps, p. 34.

50. FMFM-1, "Warfighting", U.S. Marine Corps, p. 35.

51. FMFM-1, "Warfighting", U.S. Marine Corps, p. 35.

52. FMFM-1, "Warfighting", U.S. Marine Corps, p. 36.

53. FMFM-1, "Warfighting", U.S. Marine Corps, p. 37.

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55. FMFM-1, "Warfighting", U.S. Marine Corps, p. 21.

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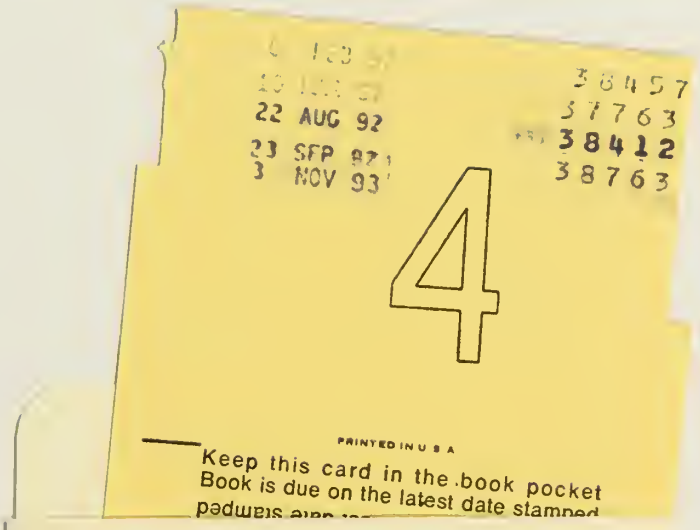

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